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SIX MONTHS EXPERIENCE

Traffic Berkeley
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BERKELEY TRAFFIC MANAGEMENT PLAN

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SIX-MONTH EXPERIENCE REPORT

ERRATA SHEET

May 11, 1976

TABLE OF CONTENTS	Line 6 should read "OBEDIENCE TO MANAGEMENT DEVICES"
p. iii	5th paragraph, next to last line should read, "STOP controls which have not been placed for valid right-of-way..."
p. 1	4th paragraph, last line should read, "The block of Channing between Fulton and Ellsworth is a case in point."
p. 4	5th line of table should read, "Warring Street north of Derby Street. 18,700 21,500 2,800 15" and this line should be deleted from page 4 and placed on page 3 under "Arterials and Collectors with Traffic Increases" between College Avenue south of Dwight Way and Bancroft Way east of Ellsworth Street.
p. 14	2nd line of table should read, "Cedar Street, Euclid to Eastshore Highway"
p. 14	McGee Avenue, the last local street should have "+" in the change column.
p. 21	4th paragraph, line 6 should read, "than causal."
p. 29	Last paragraph, 9th line, delete the words, "a major"
p. 31	First paragraph, first line, delete the word "frequent"
p. 34	First paragraph, first line should read, "Traffic speed data were collected ..."
p. 35	Last paragraph, 8th line, should read "whether these smog producing ingredients are emitted ..."
p. 38	1st paragraph, last line should read "best information which can be assembled at this time."
p. 38	3rd paragraph, 2nd line should read, "indicate minimal changes in travel time and intersection delays over arterial ..."
p. 39	Last paragraph, first line should read "There is increased difficulty for patrol cars and emergency vehicles ..."

p. 41	3rd paragraph, first line should read, "Table 16 presents crime statistics for the fourth quarter of 1975 and ..."
p. 41	5th paragraph, 4th line should read, "related to the Traffic Management Plan. The table simply evidences the ..."
p. 49	First paragraph, 3rd line should read, "Various traffic engineering ..."
p. 49	First paragraph, 5th line should read, "grouped by type of control device."
p. 50	5th paragraph, first line should read "Where parking is infrequently utilized ..."
p. 50	7th paragraph, 2nd line should read, "our judgment that ..."
p. 50	Last paragraph, first line should read, "This last point merits additional discussion. Limited available traffic ..."
p. 51	11th line of table should read, "Hearst at Ninth"
p. 51	14th line of table should read, "Neilson at San Lorenzo"
p. 61	14th line of table should read, "Claremont/Garber/ Oak Knoll"
p. 61	16th line of table should read, "Regent at South Hospital Drive"
p. 61	17th line of table should read, "Colby at South Hospital Drive"
p. 77	Last line of table should read, "Tunnel at Alvarado or Bridge"
p. 79	2nd paragraph, 4th and 5th lines should read, "neighborhood. Noise from improperly muffled motorcycles, trucks and buses were repeatedly found to disturb sleeping, talking, relaxing ..."

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ABOUT THIS REPORT

The Berkeley Traffic Management Plan has been in effect since August, 1975. In approving the plan, the City Council recognized its experimental nature and authorized implementation for a trial period only. That trial period terminates on May 31, 1976. At that time decisions about the plan will be made -- abandon it completely, keep it as is, modify it, expand it, etc. This report is intended to provide the City Council, the Planning Commission and the citizens of Berkeley some facts about the effects of the plan to assist them in determining the plan's future.

The traffic management plan has obviously had impacts which in a large variety of ways affect the quality of life in Berkeley. Many of these impacts involve individual perceptions and social value judgments. While these perceptual impacts are indeed important - in fact they are central to evaluation of the traffic management plan - their evaluation is not the object of this report. This report is intended to document some objective measurements of the impacts of the plan on traffic and community services. But it is extremely important that the contents of this report not be construed as a comprehensive evaluation of the Traffic Management Plan. Other effects of the plan on the quality of life in Berkeley must be given full consideration - such as creation of quiet residential neighborhoods where parents need no longer be constantly anxious about the safety of their children crossing the street, the quality of the environment for walking, bicycling or just sitting on one's front stoop. Some of these factors are discussed in this report but very little empirical data of this nature is available at this time.

This report was prepared jointly by staffs of De Leuw, Cather & Company and the City of Berkeley. De Leuw, Cather staff were primarily responsible for analysis of data and preparation of the report text. City staff were primarily responsible for collection of data and for analysis relating to community services, public inputs, noise levels and other effects on neighborhood environment.

SUMMARY OF FINDINGS

Implementation of the Traffic Management Plan has resulted in a number of changes affecting the quality of life in Berkeley. Following is a summary of some of the impacts of the Plan which are evaluated in this report.

- Changes in traffic volume have occurred generally as expected. Traffic on most local streets have decreased or remained unchanged. Traffic on some arterials and collector streets has increased. A few local streets, generally short segments in the vicinity of diverted streets which formerly carried substantial traffic, have suffered traffic increases. Several arterial and collector streets have benefitted from the Traffic Management Plan and experienced traffic decreases. Generally these have been streets of residential character while most of the arterial streets experiencing increase are non-residential or of mixed land-use in character.

- Traffic increases on the arterial and collector streets have not caused serious increases in congestion. Current capacity utilization ratios at key intersections are improved over those measured in 1970. Traffic operations improvements carried out in the intervening period have absorbed the impacts of Traffic Management Plan induced shifts as well as normal traffic growth.

- Overall travel times in Berkeley along the designated circulation system have not changed significantly from pre-Traffic Management Plan conditions. However, elimination of through-neighborhood shortcuts has caused increases of overall travel time on many trips. The seriousness of this change depends on whether one is travelling in an emergency situation or simply on a matter of personal convenience.

- Traffic accidents and traffic fatalities in the City are down over the period the Traffic Management Plan has been in effect though injury accidents are up slightly. Along with traffic volume, the Plan appears to shift many of the accidents which formerly occurred in neighborhoods to the bounding arterial streets. Instances of vehicles striking traffic management devices have decreased as people have become familiar with the Plan. As familiarity increases and devices are better marked, this is likely to become even less a problem.

- There is considerable disobedience of all types of traffic management devices deployed in the City.

  Violation of diverters, semi-diverters and closures occurs regularly and should perhaps be a subject of increased police enforcement. However, violation is not so frequent as to impair the effectiveness of these devices or to warrant development of more sophisticated provisions for emergency vehicle gaps.

  The undercarriage preventer blocks which guard emergency vehicle openings against violators are generally successful in discouraging violations. However, they can be crossed by any high-slung vehicles, and many private cars if driven with care. Yet they have damaged a few police vehicles during high speed crossings. In the absence of increased enforcement, the blocks appear the best compromise between unprotected emergency openings and fully closed diverters.

  Violation of circles (left turns on wrong side of circle) is frequent and involves a serious accident potential - one reason why replacement of several circles is recommended herein.

  Violation of STOP controls - failure to stop - is flagrant at many locations. Placement of STOP controls at intersections where there is perceptually little need to control right-of-way appears to have bred driver contempt and hazardous disregard for this device. Most of the obviously inappropriate STOP controls incorporated in the Plan were never installed or have been removed. Large scale occurrence of hazardous violations is one of the reasons for recommendations herein which indicate removal of all STOP controls which have been placed for valid right-of-way control purposes.

- STOP controls have had very limited effect in reducing traffic speed except in the immediate vicinity of the device itself. This is another reason for the removal recommendation above.

- Modifications to many of the devices deployed in the initial Traffic Management Plan implementation could improve their visibility and functional qualities. Numerous modifications based upon field inspections are recommended herein.

- Air quality in the Bay Area as a whole, citywide in Berkeley, or on individual Berkeley streets has not been meaningfully impacted by Traffic Management Plan implementations.

- Insufficient data is available to quantify changes in energy (gasoline) consumption resulting from Plan implementation. However, in all probability, gas consumption has increased for many trips still made in Berkeley.

- The Traffic Management Plan has had a range of effects on community services operating in Berkeley. Among these are:

  -- Little discernible effect on AC Transit operations

  -- Refuse collection service routings have been revised with little quantified effect on operation efficiency. On at least one cul-de-sac street, Tanglewood, the collection truck must back out one block after collections.

  -- Adjustments to Berkeley Unified School District bus routes have enabled continued fulfillment of school transportation requirements. However, such route adjustments are estimated to cost $10,000 for the current school year.

  -- Adjustments to the school crossing protection plan will be needed primarily due to changes in attendance because of the eathquake safety rehabilitation program. The Traffic Management Plan should be taken into account in such adjustments.

  -- Vandalism on diverters and related devices cost some $6700 for repairs in the first six months of Plan implementation. Repeated vandalism of two devices accounted for nearly two-thirds of all vandalism.

  -- No catastrophic incidents resultant from Traffice Management interference with fire protection services have been reported but the Fire Department is concerned that the risk of serious incidents may be overlooked. A specific design criteria for the Traffic Management Plan was mobility of fire protection apparatus. However, emergency access openings have been blocked by parked cars or apparatus otherwise delayed by Traffic Management devices on at least five occasions since the Plan implementation. Several new hydrant installations will be required if certain diverters are made permanent. If the Plan is continued, measures should be taken to ensure the quality of fire protection services in Berkeley.

-- Crime statistics and police response time data provide no substantiation that the Traffic Management Plan has adversely affected the overall quality of police services in Berkeley. However, individual incidents and perceptions of patrol officers indicate potential for problems. Increased manpower and resource allocation to the Patrol Division could offset potential adverse effects of the Plan and lead to better traffic enforcement.

- Numerous citizen communications regarding Traffic Management have been received regarding the Plan both before and after implementation. The balance of citizen view on Traffic Management, pro or con, cannot be judged on the basis of communications received. However, these communications have been of great value in pointing up issues of concern related to the Plan and suggestions for specific device modifications.

EFFECT ON TRAFFIC VOLUMES

It is very clear that the Traffic Management Plan has largely achieved its primary intended effect -- shifting traffic from local residential streets to designated arterials and collectors. At this time it is not possible to quantify all the changes which have occurred -- it has not been possible to make enough counts to measure them. However, from the count data which has been taken and which is summarized on Tables 1 and 2, these conclusions are evident:

- The pattern of traffic shifts generally has occurred as anticipated before Plan implementation.

- The Traffic Management Plan has meaningfully reduced traffic on most impacted local streets.

- Relatively few local streets have experienced significant traffic increases as a result of diversions on other local streets. However, some local streets in the vicinity of other diverted streets which formerly carried heavy traffic have suffered significant increases. The block of Channing between Fulton and Shattuck is a case in point.

- Comparative before and after traffic volume data is available for some 36 local streets. All diverted streets counted experienced traffic reductions. Of the ten undiverted local streets counted, five suffered significant undesired traffic increases. It should be noted that count locations on undiverted local streets were selected at points where it was suspected that adverse traffic increases might have occurred. The fact that only half of these sensitive locations actually did suffer increases indicates that the Traffic Management Plan has had less undesired internal neighborhood effects than might have been expected. Most undiverted local streets in Berkeley are not susceptible to traffic increases resulting from the Plan and have not suffered such increases. The local streets feared susceptible to traffic increases have not experienced them. If the Traffic Management Plan is retained, measures to protect those local streets which have experienced increases should be considered.

- Most traffic increases which have occurred on arterials streets have been on streets where such increases are not likely to cause serious problems. Generally, these streets are non-residential in character and have adequate capacity to accept the traffic increases. One exception is on Belrose where closure of Tanglewood and other diversions has caused a sharp increase (5800 vehicles daily) on a residential arterial where traffic reduction would be desirable. It should be noted that total traffic in the Claremont-Belrose-Derby/Claremont-Tanglewood-Derby corridor has not changed significantly. Most of the change on the Belrose portion results from the closure of Tanglewood. But while the total traffic entering Southeast Berkeley via this corridor remains the same, it is quite likely that different drivers now use the corridor than before Traffic Management Plan implementation.

Table 1
TRAFFIC VOLUME CHANGES

Street	Location	Daily Traffic Volumes			
Local Street with Decreased Traffic		Before	After	Change	Percent Change
Fulton St.	south of Parker St.	9,100	900	8,200	90
Allston Way	west of Acton St.	5,700	1,900	3,800	66
Ellsworth St.	south of Parker St	4,500	1,000	3,500	78
Ellsworth St.	south of Haste St.	4,200	1,400	2,800	65
Milvia St.	south of Parker St.	2,800	400	2,900	86
Allston Way	west of California St.	6,500	4,200	2,300	35
Russell St.	west of Piedmont Ave.	2,600	1,000	1,600	61
Woolsey St.	east of Hillegass Ave.	2,400	1,000	1,400	57
Woolsey St.	west of Telegraph Ave.	1,600	400	1,200	75
Blake St.	east of Fulton St.	2,300	1,300	1,000	44
Woolsey St.	east of College Ave.	1,700	900	800	47
Rose St.	west of California St.	2,900	2,200	700	23
Derby St.	east of College Ave.	2,100	1,500	600	28
Webster St.	east of College Ave.	1,200	700	500	42
Milvia St.	north of Rose St.	1,200	700	500	42
Prince St.	east of College Ave.	700	400	300	40
Domingo Ave.	north of The Plaza Dr.	650	350	300	47
Piedmont Ave.	north of Webster St.	850	600	250	28
Eton Ave.	south of Woolsey St.	400	250	150	41
Hazel Rd.	east of Claremont Ave.	550	400	150	23
Bancroft Way	east of California St.	2,200	2,050	150	7
Carleton St.	east of Fulton St.	1,350	1,250	100	6
Parker St.	east of Milvia St.	1,350	1,250	100	6
Channing Way	east of California St.	550	500	50	8
Lewiston Ave.	south of Woolsey St.	290	270	20	6
Stuart St.	east of Fulton St.	980	980	0	0

Table 1 (continued)
TRAFFIC VOLUME CHANGES

Street	Location	Daily Traffic Volumes			
Local Street with Increased Traffic		Before	After	Change	Percent Change
Channing Way	east of Fulton St.	1,900	3,900	2,000	103
Addison St.	west of Acton St.	1,600	2,100	500	30
Addison St.	east of California St.	2,600	3,050	450	17
Rose St.	east of California St.	3,100	3,450	350	11
Acton St.	south of Allston Way	650	800	250	34
Derby St.	east of Fulton St.	2,000	2,150	150	8
Parker St.	east of Fulton St.	2,350	2,450	100	5
Russell St.	west of College Ave.	2,500	2,600	100	5
Santa Fe Ave.	north of Talbot Ave.	800	900	100	15
Channing Way	west of Acton St.	900	950	50	4
Arterials and Collectors with Traffic Increases					
Shattuck Ave.	north of Ashby Ave.	12,000	20,300	8,300	69
Shattuck Ave.	south of Dwight Way	23,000	29,800	6,800	29
Belrose Ave.	south of Derby St.	16,000	21,800	5,800	36
Adeline St.	north of Ashby Ave.	12,900	17,500	4,600	36
Gayley Road	near Campus	14,000	18,200	4,200	30
Grove St.	north of Ashby Ave.	15,000	18,900	3,900	26
Dwight Way	east of Fulton St.	9,500	13,300	3,800	41
Grove St.	south of Dwight Way	16,800	20,600	3,800	22
Telegraph Ave.	north of Ashby Ave.	23,300	26,700	3,400	15
College Ave.	south of Dwight Way	9,500	12,800	3,300	35
Bancroft Way	east of Ellsworth St.	13,000	15,800	2,800	22
Tunnel Road	north of Alvarado Rd.	29,700	32,000	2,300	8
College Ave.	north of Russell St.	13,000	15,200	2,200	17
Hearst Ave.	east of McGee Ave.	5,000	6,000	1,000	20
Haste St.	east of Ellsworth St.	6,000	6,900	900	15
Hopkins St.	east of McGee Ave.	3,500	4,300	800	23
Dwight Way	east of California St.	9,100	9,750	650	7
College Ave.	south of Woolsey St.	13,800	14,000	200	2
Alcatraz Ave.	east of College Ave.	2,300	2,400	100	5

Table 1 (continued)
TRAFFIC VOLUME CHANGES

Street	Location	Daily Traffic Volumes			
Arterials & Collectors w/Traffic Decreases		Before	After	Change	Percent Change
Ashby Ave.	east of Fulton St.	28,500	22,700	5,800	20
University Ave.	east of California St.	32,100	28,400	3,700	11
Ashby Ave.	east of Linden Ave.	23,000	19,400	3,600	16
Spruce St.	north of Eunice St.	7,500	4,500	3,000	40
Warring St.	north od Derby St.	18,700	21,500	2,800	15
Fulton St.	north of Dwight Way	10,000	7,700	2,300	23
University Ave.	west of Acton St.	35,800	33,500	2,300	6
Cedar St.	east of Sacramento St.	7,900	6,100	1,800	23
Monterey Ave.	north of Hopkins St.	4,800	3,100	1,700	34
Spruce St.	north of Glen Ave.	6,700	5,100	1,600	24
Durant Ave.	east of Ellsworth St.	10,200	9,100	1,100	11
Derby St.	east of Warring St.	20,400	19,400	1,000	5
Sacramento St.	south of Russell St.	16,500	15,500	1,000	6
Colusa Ave.	north of Tacoma Ave.	7,000	6,000	1,000	14
The Uplands	east of Claremont Ave.	3,100	2,250	850	27
Grove St.	north of Cedar St.	14,800	14,000	800	5
Ashby Ave.	west of King St.	23,000	22,400	600	3
Dwight Way	west of Acton St.	8,900	8,450	450	5
Claremont Ave.	south of Eton Ave.	9,500	9,200	300	3
Cedar St.	west of Milvia St.	8,450	8,200	250	3
Delaware St.	west of Franklin St.	3,300	3,050	250	7
Euclid Ave.	south of Cedar St.	8,500	8,350	150	2
Dwight Way	west of Piedmont Ave.	7,000	6,950	50	1

Table 2
SUMMARY OF TRAFFIC VOLUME CHANGE MEASUREMENTS

Local Streets		Arterials and Collectors	
Absolute Traffic Change	No. Streets with Change	Absolute Traffic Change	No. Streets with Change
-5000+	1	-5000+	1
-2000 to -5000	5	-2000 to -5000	6
-1000 to -2000	4	-500 to -2000	10
-200 to -1000	8	Small change	8
Small change (-200 to +200)	13	+500 to +2000	4
+200 to +2000	4	+2000 to +5000	10
+2000+	1	+5000 to +10,000	3
Percentage Change		Percentage Change	
-75%+	4	-40%+	1
-50% to -75%	4	-20% to -40%	6
-25% to -50%	10	-10% to -20%	5
0 to -25%	8	0 to -10%	11
0 to +25%	7	0 to +20%	7
+25% to +50%	2	20% to +40%	10
+50%+	1	+40% to -70%	2
		+70%+	0

- A number of arterial and collector streets, although undiverted, have experienced meaningful traffic decreases as a result of Traffic Management implementations on other streets. Most of the arterial and collector streets which have experienced such decreases are predominantly residential in character.

- The largest single change in traffic volumes in Berkeley stems from diversion of the Fulton-Ellsworth, one-way couplet. This measure is directly responsible for route shifts by some 12,000 vehicles per day. No other diversion measure undertaken in the Plan has affected as much as one-third the traffic affected in the Fulton-Ellsworth corridor.

- It is difficult to draw any inferences about changes in the total amount of traffic in Berkeley on the basis of available count data. There are simply too few counts taken at comparable locations to do this. In addition, many of the "before" counts were taken at least three years ago and at some points the most recent "before" counts are as much as six years old. This has important implications.

  At some points, older counts may reflect a temporary situation or fail to reflect the impact of a major new traffic generator located nearby. Cases in point are Shattuck Avenue and Adeline Street where the available "before" traffic data reflects the impact of BART construction which depressed traffic volumes on those streets.

  In the comparison of current with older counts, the general traffic growth which has occurred over the intervening years tends to mask the impact of traffic shifts which have resulted from the Traffic Management Plan. Because of general traffic growth over several years which has not been taken into account on Table 1, traffic decreases indicated thereon as resultant from the Traffic Management Plan are generally understated and traffic increases are generally overstated. Working with available data, there is very limited indication whether or not the Traffic Management Plan may have contributed to an overall traffic decrease in Berkeley. Table 3 presents crossing traffic on the one screen line for which a full set of comparative counts could be assembled -- an east-west line north of Ashby Avenue. The 1976 traffic volumes are up by some 8,000 or six percent over 1972 levels. Annual traffic growth over the period as determined from the City's master count station, would account for only about 1,000 vehicles. The remaining 7,000 change could well be less than the total diversions from local streets and the ongoing San Pablo Avenue reconstruction project, indicating a net traffic decrease across the screen line. But this is purely speculative and more complete count data is needed to fully assess the implications of traffic changes which have occurred.

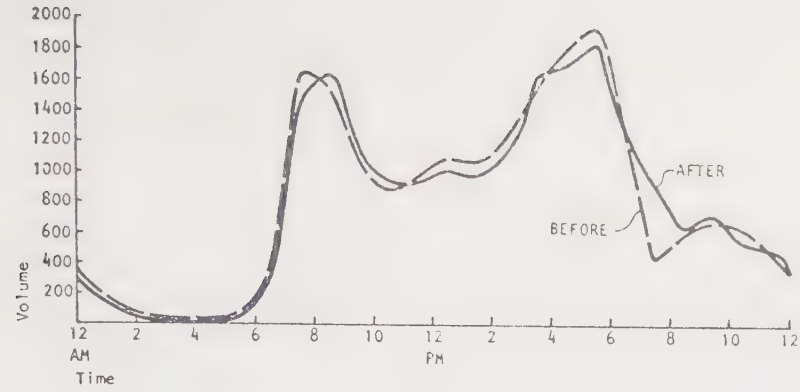
- Generally, distributions of traffic over the course of the day have remained quite similar on local streets, whether diverted or not, and

Table 3
EAST-WEST SCREENLINE NORTH OF ASHBY AVENUE

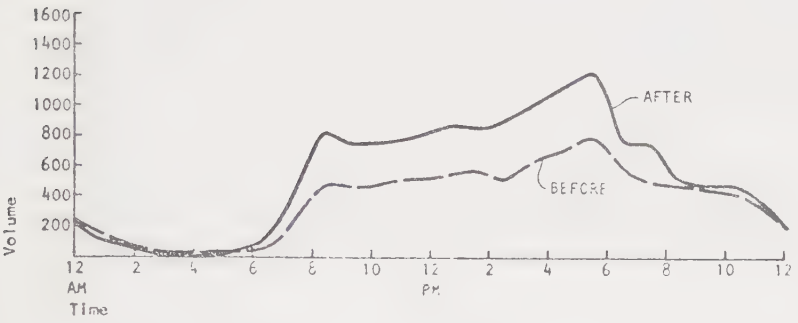
Street	1972	1976
Sacramento Street	16,500	15,500
Grove Street	15,000	18,900
Adeline Street	12,900	17,500
Shattuck Avenue	12,000	20,300
Fulton Street	8,800	1,000
Ellsworth Street	5,100	1,000
Telegraph Avenue	23,300	26,700
College Avenue	13,000	15,200
Derby Street*	20,400	19,400
TOTAL	127,000	135,500

*West of Belrose; functioning as north-south linkage at this point.

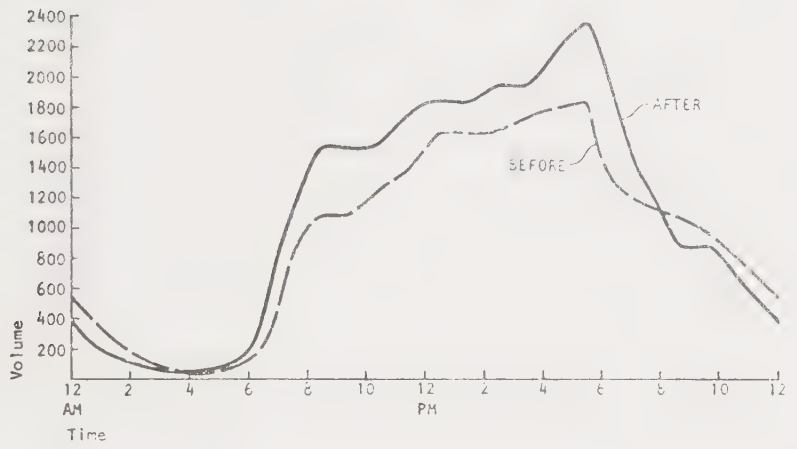
on the arterials. Figure 1 shows daily traffic distribution on five selected streets. Although volumes have changed on all to some extent, none shows any dramatic effects on daily traffic pattern such as elimination of commute hour peaks or elimination of a significant volume of late night traffic. The Allston Way case does show a limited tendency to reduction of peak period and late night traffic. But in general the Traffic Management Plan appears to have had little effect on the distribution of traffic over the course of the day in Berkeley.



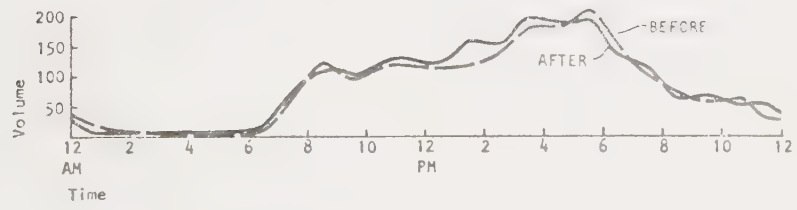
DERBY STREET
ARTERIAL WEST OF WARRING STREET



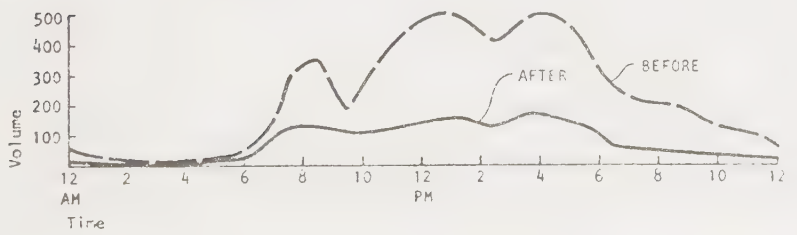
DWIGHT WAY
ARTERIAL EAST OF FULTON



TELEGRAPH AVENUE
ARTERIAL NORTH OF ASHBY AVE



DERBY STREET
UNDIVERTED LOCAL STREET EAST OF FULTON STREET



ALLSTON WAY
DIVERTED LOCAL STREET WEST OF ACTON STREET

Figure 1
HOURLY PATTERNS OF TRAFFIC-VOLUME VARIATION

TRAFFIC CONGESTION

The principal traffic engineering measure of traffic congestion conditions on an urban surface street is the level of utilization of capacity at intersections. Comprehensive evaluations of available capacity and capacity utilization for all signalized intersections in Berkeley were last performed in 1970 as part of the Berkeley Traffic Signal Evaluation Study. Post-traffic management plan measurements of intersection capacity utilization were made at selected intersections in the spring of 1976. Table 4 indicates the comparison of capacity utilization rates.

The intersections studied were selected to determine representative conditions in all parts of the City although there was some concentration of selections in heavily diverted areas. No intersections were selected in western Berkeley due to the disruptive impacts of ongoing construction along San Pablo Avenue.

In interpreting the results on Table 4, the lower the utilization rates, the less congested the intersection. Utilization levels below 75 percent indicate uncongested operations. Rates between 75 and 85 percent indicate light congestion with occasional backups forcing some vehicles to wait through more than one signal cycle. At utilization rates between 85 and 100 percent, facilities are severely congested but functional. During brief traffic surges within the peak period, significant numbers of vehicles may be forced to wait through more than one signal cycle. However, periodic clearance of queues occurs preventing long standing backups. At utilization rates above 100 percent, very severe congestion is experienced, with long standing queues of vehicles delayed through more than one signal cycle.

Changes in capacity utilization shown on the table are not solely due to effects of the traffic management plan. They reflect normal traffic growth which has occurred over the six intervening years and effects of operational improvements made at all but one of the intersections studied as well as shifts in traffic volume and intersection movement patterns caused by the Traffic Management Plan.

The table shows that of the twelve intersections studied, congestion (capacity utilization level) has decreased at seven, at three it has remained virtually unchanged, and at only two has congestion increased. Of the two at which conditions have worsened, only one changed to a more serious degree of congestion. And only one of the intersections studied, which include many of the busier and more troublesome intersections in Berkeley, can be said to have a serious congestion problem.

Virtually all the intersections studied carry more traffic now than they did in 1970. But the analysis shows that motorists generally now suffer no more delay at major intersections than they did six years ago. Opera-

Table 4

INTERSECTION CONGESTION COMPARISON

Intersection	1970 Percent Utilization of Capacity	1976 Percent Utilization of Capacity
Ashby-Claremont	85	91
Ashby-College	87	78
Ashby-Telegraph	76	60
Ashby-Shattuck	68	75
Cedar-Grove	69	63
Cedar-Shattuck	76	60
Dwight-Grove	95	73
Dwight-Shattuck	65	66
Dwight-Telegraph	58	59
Hearst-Euclid	84	74
University-Grove	76	75
University-Sacramento	66	59

tional improvements -- such things as changes in signal timing, parking removals, rechannelization of approaches -- have enabled absorption of normal traffic growth and traffic shifts caused by the Traffic Management Plan without increasing congestion at most intersections.

At some intersections traffic conditions have probably deteriorated from what they were in the period immediately preceding Traffic Management Plan implementation. At others, such as College and Ashby where changes were made as part of the traffic management implementation, conditions are perceptibly improved over a year ago. However, a complete evaluation of the changes which have occurred over the short term cannot be made because no data on intersection conditions in early 1975 is available. The comparison from 1970 to the present shows that intersection conditions with the traffic management plan are generally no worse than they have been in the relatively recent past. This period of comparison reflects almost the full duration over which traffic management has been a subject of discussion in Berkeley.

The analysis of current intersection conditions (with traffic management) indicates no intersections suffering absolute breakdowns in peak period operations and indicates overall conditions generally acceptable in relation to urban norms.

TRAVEL TIME COMPARISON

Travel time measurements taken in 1973 were compared with similar measurements made in April, 1976. Measurements were made on arterials and collectors on undiverted local streets and on diverted local streets (following a reasonable route around the diverter). Only two or three runs were made on each street so the data is not suitable for any rigorous statistical analysis. However, the results are quite clear. Overall travel times have increased in Berkeley, but generally very little. Cases such as on Shattuck Avenue, average travel speed has actually increased (travel time decreased). Table 5 shows average travel speed (average speed from point to point including running time and stops) for some typical arterials and local streets in Berkeley. Changes in overall travel speed are relatively minor. Generally, it is not likely to take more than a minute or two longer now than in 1973 to travel across Berkeley from north to south or from east to west along a relatively direct arterial or local street route. However, persons who formerly followed local street routes to avoid major signalized intersections may have several minutes added to their trips across Berkeley. Also, persons who are caught in a maze of diverters or become disoriented by them are likely to be delayed considerably, but this usually does not happen more than once or twice to any individual. And when incidents such as a traffic accident cause a tie-up on major streets, it is more difficult to use local streets as a detour, again costing some time.

The value of the small increments of travel time lost or saved by individuals in this case is difficult to establish. When one is traveling on matters of personal convenience, a difference of a minute or two matters little. But to a person traveling in an emergency situation such a difference can be extremely important.

In summary, travel time along major continuous routes in Berkeley has not changed considerably. However, opportunities for many short-cuts through neighborhoods have been eliminated along with the time savings the short-cuts afforded to their former users. Generally, travel time changes are not so large as to impose serious disbenefits on those who experience them except for persons traveling in emergency situations.

Table 5
TRAVEL TIME AND TRAVEL SPEED CHANGES

Streets	Travel Time (mins.: sec.)			Average Travel Speed Change
	Before	After	Change	
Arterials				
Ashby-Tunnel Hiller Dr. to Eastshore Frwy.	6:28	7:21	+0:53	-3.3 MPH
Cedar Street Euclid to Eastshore Frwy.	8:00	9:05	+1:05	-2.5 MPH
Shattuck-Sutter Hopkins to Alcatraz	7:48	6:52	-0:56	+2.5 MPH
University Avenue Oxford to Eastshore Frwy.	5:59	6:28	+0:29	-2.2 MPH
Local				
Eunice Street Euclid to Grove	2:44	3:18	+0:34	-3.6 MPH
Grant Street Rose to Russell	5:20	5:45	+0:25	-1.6 MPH
McGee Avenue Hopkins to Russell	6:09	7:14	-1:05	-2.9 MPH

EFFECT ON TRAFFIC ACCIDENTS

Implementation of the Traffic Management Plan has not had the disastrous impact on traffic accidents alleged by some critics. Overall traffic accident totals have decreased slightly but accidents involving personal injury have increased slightly. However, changes in all accident categories are well within the normal range of variations of accident rates experienced in Berkeley irrespective of Traffic Management. One definitely noticeable trend is that Traffic Management implementation has significantly changed traffic accident patterns in the sense of where the accidents happen and what types of accidents occur.

Table 6 presents data from Berkeley citywide accident record summaries for the first six months of Plan implementation and data for the same six months a year previous (August 1975 through January 1976 versus August 1974 through January 1975). Total accidents decreased by three percent. Accidents involving only property damage decreased by six percent. Accidents involving personal injury increased by six percent. Figure 2 illustrates typical fluctuations in accident occurrence for several East Bay cities, including Berkeley. Annual changes in Berkeley accident totals have normally been relatively stable over the past several years both in absolute terms and in comparison to changes experienced in nearby cities. But the differences in accident occurrence before and after Traffic Management Plan implementation falls well within the normal range of annual and monthly accident fluctuation.

Hence, there is little indication that the Traffic Management Plan has caused any meaningful increase or decrease in the number and severity of accidents in Berkeley citywide.

Table 6 does show a very high percentage decrease (71 percent) in the number of fatal accidents. It would be premature to claim that traffic management has produced a significant decrease in traffic fatalities -- the number of accidents involved is far too small for any statistically reliable conclusions to be inferred. However, the limited evidence available definitely gives indication that Traffic Management if anything has decreased, not increased, the likelihood of traffic fatalities, contrary to allegations by some.

Traffic Management does appear to have had a significant effect upon where and what types of accidents occur. Tables 7, 8 and 9 compare location and type of accident occurrence over three month periods in and around two typical Berkeley neighborhoods before and after Traffic Management Plan implementation.* The two neighborhoods, Le Conte in south-central Berkeley

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*Comparison of October through December, 1975, to October through December, 1973, was done because of partial Traffic Management implementations which took place during 1974.

TABLE 6

SIX-MONTH ACCIDENT COMPARISON CITYWIDE

Month	Non-Injury			Injury			Fatal			Total		
	Before	After	Change	Before	After	Change	Before	After	Change	Before	After	Change
August	283	246	-13%	89	102	+15%	0	1	+100%	372	349	- 6%
September	272	276	+ 1	110	98	-11	1	0	-100	383	374	- 2
October	306	316	+ 3	103	125	+21	1	0	-100	410	441	+ 7
November	299	261	-13	114	114	0	1	0	-100	414	375	-10
December	303	281	- 7	104	112	+ 8	3	1	- 67	410	394	- 4
January	271	250	- 8	96	107	+11	1	0	-100	368	357	- 2
TOTAL	1,734	1,629	- 6%	616	655	+ 6%	7	2	- 71%	2,357	2,286	- 3%

Before = August 1974 to June 1975
After = August 1975 to June 1976

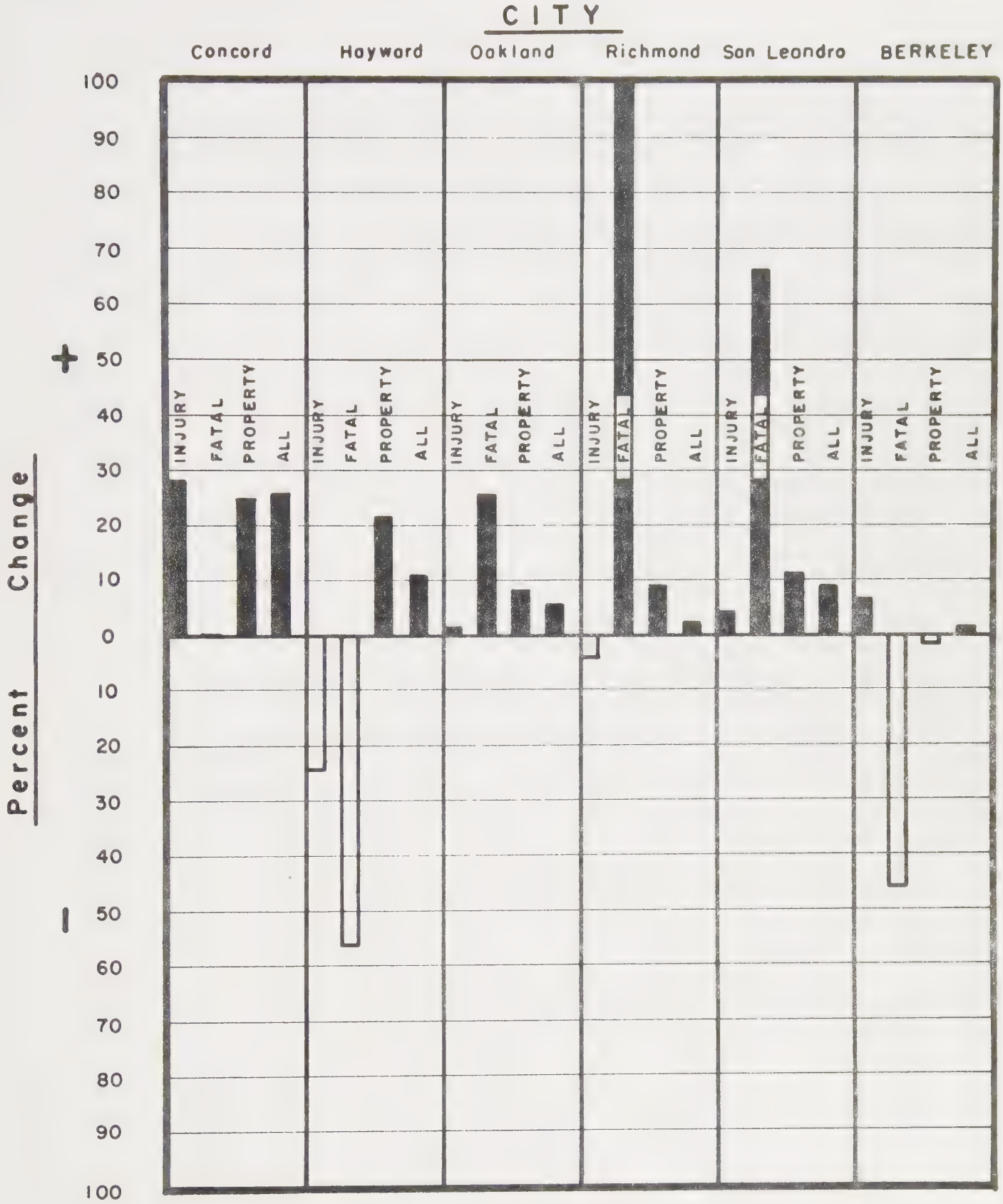


Figure 2
ACCIDENTS - YEAR 1974 VS YEAR 1975

TABLE 7

ACCIDENT COMPARISON -- LE CONTE NEIGHBORHOOD AREA

Type of Accident	Neighborhood Local Streets		Bounding Arterials	
	Before*	After**	Before*	After**
Broadside	11	--	16	14
Sideswipe	6	3	15	8
Pedestrian-Auto	--	--	3	2
Bicycle-Auto	--	1	2	4
Head-On	1	--	1	3
Rear-End	1	2	12	17
Hit Fixed Object	1	1	1	9
Overturned	--	--	--	--
Other	--	--	--	1
TOTALS	20	7	50	58

*Pre-Traffic Management Plan implementation, October, November, December, 1973

**Post-Traffic Management Plan implementation, October, November, December, 1975

TABLE 8

ACCIDENT COMPARISON -- WEST BERKELEY NEIGHBORHOOD AREA

Type of Accident	Neighborhood Local Streets		Bounding Arterials	
	Before*	After**	Before*	After**
Broadside	9	1	11	16
Sideswipe	4	1	12	9
Pedestrian-Auto	1	--	6	3
Bicycle-Auto	1	--	--	--
Head-On	--	1	2	1
Rear-End	5	5	17	13
Hit Fixed Object	1	2	1	2
Overturned	--	--	--	1
Other	--	1	--	2
TOTALS	21	11	49	47

*Pre-Traffic Management Plan implementation, October, November, December, 1973

**Post-Traffic Management Plan implementation, October, November, December, 1975

TABLE 9

ACCIDENT COMPARISON -- BOTH NEIGHBORHOODS

Type of Accident	Neighborhood Local Streets		Bounding Arterials	
	Before*	After**	Before*	After**
Broadside	20	1	27	30
Sideswipe	10	4	27	17
Pedestrian-Auto	1	--	9	5
Bicycle-Auto	1	1	2	4
Head-On	1	1	3	4
Rear-End	6	7	29	30
Hit Fixed Object	2	3	2	11
Overturned	--	--	--	1
Other	--	1	--	1
TOTALS	41	18	99	105

*Pre-Traffic Management Plan implementation, October, November, December, 1973

**Post-Traffic Management Plan implementation, October, November, December, 1975

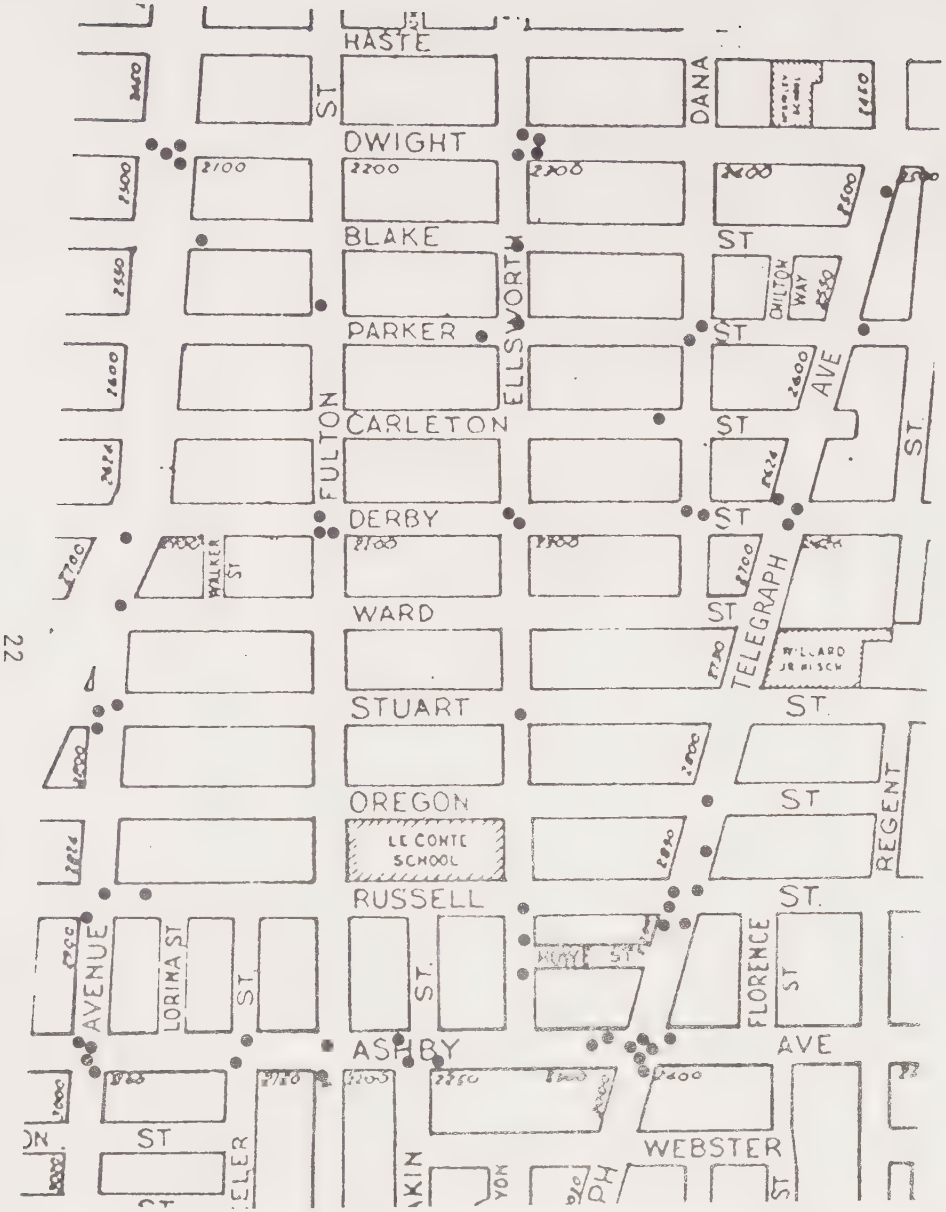
and West Berkeley, were selected to illustrate the effects of quite different types of traffic management. Several diverters were deployed in Le Conte as well as a number of STOP signs. In West Berkeley, traffic management implementation consisted primarily of placement of STOP signs at hazardous intersections -- a few diverters had been deployed in an earlier program some years ago. In both areas total accidents decreased slightly after Traffic Management Plan implementation, consistent with the citywide findings discussed above. But significantly, both neighborhoods experienced large drops in accidents on local streets. In Le Conte, the diverters appear to shift accidents along with traffic from the local streets to the bounding arterials. In West Berkeley the intersection control improvements appear to have eliminated accidents rather than shifting them. Figures 3 and 4 illustrate changes in accident location patterns. The reductions in local street accidents, whether by shift to arterials or elimination, can be regarded as a neighborhood benefit consistent with the objectives of neighborhood traffic management.

The change in accident types which accompanies the change in accident location pattern in the Le Conte case is also significant. As Table 7 shows, a large portion of the local street accident reduction is in the potentially severe "broadside" category. Corresponding increases in arterial accidents are concentrated in normally less severe categories.

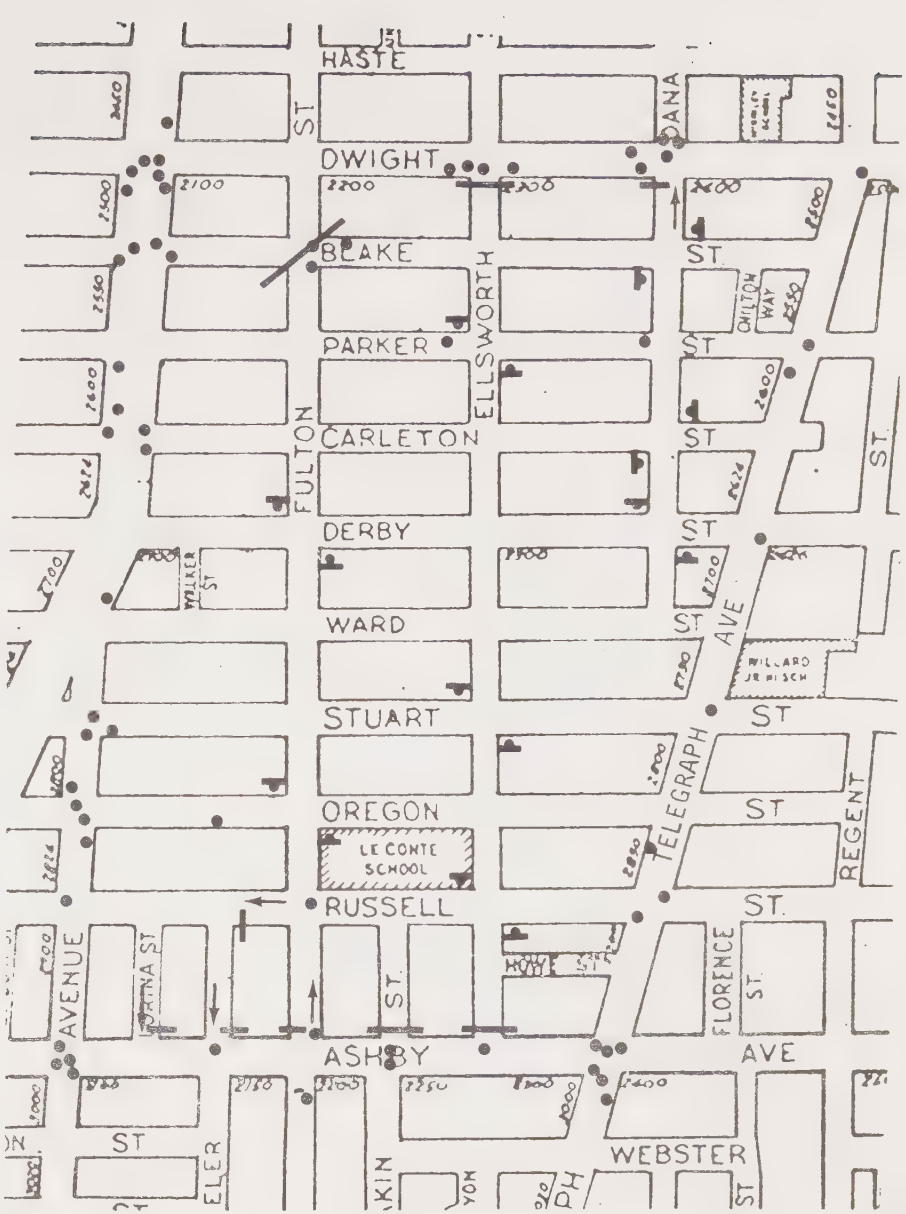
There have been a number of accidents involving vehicles colliding with or colliding because of traffic management devices. However, the six month accident comparison presented previously clearly shows that the Traffic Management Plan probably has prevented many more accidents than those to which the devices have specifically been contributory.

Police accident records for a slightly over four month period immediately after most diverters and other devices were installed (September 1975 through January 1976) include 25 cases where a diverter, semi-diverter, circle or closure was in some way involved in a traffic accident. In some of these cases, diverter involvement may have been incidental rather than casual. Other incidents may actually have stemmed from deliberate attempts to vandalize or pass through the diverters. But overshadowing all of this is experience in the subsequent three month period (February through April, 1976) in which only six additional accidents of this type have occurred. This confirms the expectation that as motorists become more familiar with the location and nature of the devices, such accidents will occur far less frequently than they did in the initial deployment period. Moreover, other sections of this report contain recommendations for improved signing and marking of diverters and other devices as well as suggestions for removal or modification of other specific control devices. If the recommended measures are carried out, they should help further reduce overall accidents in Berkeley and particularly those directly involving traffic management devices.

In summary, the Traffic Management Plan has resulted in a net reduction of traffic accidents in neighborhoods and may be the primary factor in a



BEFORE



AFTER

LEGEND
- Accident
- Stop Sign
- Diverter

Figure 3
EFFECT ON ACCIDENTS
Le Conte Neighborhood Area

BEFORE

AFTER

LEGEND
- Accident
- Stop Sign
- Diverter
- Traffic Circle

Figure 4
EFFECT ON ACCIDENTS
West Berkeley Neighborhood Area

small reduction of overall traffic accidents in Berkeley. Available limited evidence indicates that if anything, Traffic Management has decreased, not increased fatal traffic accidents in Berkeley. Accidents directly involving diversion devices have decreased significantly since the initial deployment period and further reductions may be realized if improvements recommended herein are implemented. Overall, the Traffic Management Plan has not caused the accident problem which critics have alleged; it appears to have had a net beneficial effect on traffic safety. However, conclusions based on the variations in accidents over periods as observed herein must be drawn with caution. This is because these changes fall within normal changes in accident incidence which occurs even when little or no roadway system and enforcement changes have been made.

OBEDIENCE TO TRAFFIC MANAGEMENT DEVICES

Driver violation of various traffic management devices is a point of considerable traffic safety concern, an issue which affects the basic effectiveness of the Plan and a topic of citizen complaints. The sections which follow discuss the subject of violation or disobedience of the principal traffic management controls used in Berkeley.

Diverters, Semi-Diverters and Closures

Violations of diverters -- passing wrong-way around semi-diverters or through gaps left for emergency vehicles in full diverters and closures -- are common occurrences. Although violations do occur and are a problem, the frequency of violation is not even close to levels at which the overall effectiveness of diversion devices in shifting traffic from residential streets might be called into question. The "undercarriage preventers" (blocks) which currently guard "emergency openings" in most diverters and closures appear to be effective in discouraging most unauthorized travel. They also appear to be a better solution, except in some special cases, than a more elaborate type of automated gate device.

Frequency of diverter violation appears to be a function of both the type of device and the details of its placement. Semi-diverters and diverters with open gaps are more likely to be violated than those with gaps protected by an "undercarriage preventer." And diverters or closures which "trap" the motorist, leaving no alternative but to turn around completely or violate the diverter, seem to experience more violations than those requiring a motorist to simply turn onto a cross street.

Table 10 shows one measure of violation frequency, a comparison of numbers of drivers who elected to violate it. The table shows a broad range in violation rate with the semi-diverter, clearly the easiest to bypass, being evaded by nearly one-third of those who approach it. The semi-diverter in the case indicated on Table 10 appears to be at the upper limit of violation rate typically experienced at semi-diverters and at diverters and closures located in a "trap" situation and, having unprotected emergency vehicle gaps -- that is, no "undercarriage preventer."

Table 10
DIVERTER VIOLATIONS VS. APPROACHES

Location	Type of Diverter	Total Movements	Total Violators	Percent Violations
Webster/Telegraph	Semi-Diverter	154	46	30
Derby & Piedmont	Full with Block	433	6	1
Blake & Fulton	Full with Block	388	8	2
Woolsey & Hillegass	Full with Block	250	17	7
Russell & Piedmont	Full with Block	246	29	12

VIOLATIONS

WRONG WAY AT SEMI-DIVERTER

SHORT CUT LEFT TURN AT TRAFFIC CIRCLE

TRAVEL THROUGH OPEN EMERGENCY ACCESS GAP AT CLOSURE

BYPASS AROUND CLOSURE

It seems obvious that a relatively high percentage of people who actually come face to face with a diverter will violate it. Most of the motorists who are "obedient" to the diversion devices now avoid the diverted street entirely. Hence, a more realistic measure of diverter "effectiveness" is a comparison of diverter violations to the volume of traffic the street carried before the diverter was installed. Table 11 presents such a comparison.

Table 11
DIVERTER EFFECTIVENESS

Streets	Gap Protection	Traffic Volume Affected	Daily Violations	Violation Rate
Fulton, north of Ashby	block	9,000	184	2 Percent
Russell, west of Milvia	block	2,000*	275**	14 Percent
Webster, west of Bateman	open	3,000*	188	7 Percent
Webster, west of Claremont	open	1,400	70	5 Percent
Woolsey, east of Wheeler	block	1,600	104	6 Percent

*estimated
**most violations traverse vacant lot, not diverter

Examined in this context, the diverter devices presently employed appear unquestionably effective in shifting traffic from local residential streets despite violations. Violations are occurring with sufficient frequency to be a source of irritation to residents and to motorists who do obey the devices and a potential hazard on occasion. However, they do not occur so frequently as to call into question the basic design of the devices or the overall effectiveness of the Traffic Management Plan. Adjustment of individual devices may be necessary to eliminate site conditions causing particularly high rates of violation at some locations.

Examination of Table 11 does seem to indicate that there is little difference in violation of an open gap versus one protected by an undercarriage pre-

venter. However, this is contrary to field observations which definitely indicate that the undercarriage preventers do discourage many would-be diverter violators. It is probable that the rate of violations at the limited number of diverters cited in Table 11 predominantly reflect specific site conditions rather than inherent violation rates at open and block-protected diverter gaps.

It would be possible to guard all emergency vehicle gaps with automated gate devices and probably reduce violations. However, such devices are far more costly than the undercarriage blocks. And the one such gate device which was deployed (at Piedmont and Russell) was subject to such frequent vandalism and other breakage that it has been removed. Another reason why widespread use of such gates does not appear appropriate is that they would deny use of the emergency gaps to all private vehicles. Drivers of many cars can, driving with care, negotiate most of the undercarriage barriers without damage to their vehicles. So the existing emergency gaps may be useful to private vehicles on emergency trips. An opening gate would probably work only for "official" emergency and service vehicles.*

The numbers of diverter violations observed in these studies do seem to indicate that this might be a fruitful area for increased enforcement efforts. In field observations it appeared that a predominance of diverter violators were not persons unfamiliar with the streets and surprised to be confronted by a diverter. Most violators appeared to know how to get around or through the devices and seemed unhesitant in doing so. This is indicative that they are familiar with the devices in general, probably the site in particular, are little concerned about enforcement and are likely habitual violators. Service and delivery trucks were noted to comprise a high percentage of violators and pass through diverters almost routinely. If the level of diverter violation is to be reduced, increased enforcement appears the most obvious measure short of installing more elaborate devices protecting the emergency vehicle openings. Another possible benefit of increased diverter enforcement is that the undercarriage barriers could be removed, thereby enhancing emergency accessibility for all types of vehicles.

The total Traffic Management Plan implementation has placed a very large new burden of traffic enforcement needs on the Berkeley Police Department. If effective enforcement of diverters and other new devices is to take place, new resources must be made available to the Police Department or reallocated from other enforcement activities.

Circles

Formal studies of traffic circle violations - left turns made on the wrong side of the circle - were not undertaken in this study. However, observations during field inspection of Traffic Management Devices showed an extremely high frequency of this type of hazardous violation.

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*Few passenger autos can negotiate the undercarriage barriers at anything approaching normal driving speeds. Some six police cars have been damaged by passing over the undercarriage devices at high speed.

Reasons for prevalence of this type violation are readily perceptible. Large tractor-trailer rigs and some large single-unit trucks, which fortunately do not use streets on which circles have been deployed very often, simply cannot make left turns by "keeping right" around the circle. Other trucks could execute left turns properly but only with difficulty and only if parked cars have not encroached on the circle approaches. Motor vehicles can properly execute left turns around the circles but many drivers take the easier and quicker "wrong-way" route. And at some intersections -- where the two legs of one street are offset from one another at their meeting with the cross-street, intersections such as Hillegass with Derby -- left turns from at least one approach leg should not be required to go around the circle. But this seems to encourage left turning drivers on the other approaches to make illegal turns.

This left turning behavior is a significant concern -- traveling on the wrong side of the street while executing a left turn, sometimes under restricted sight clearance conditions, is fraught with potential for serious head-on collisions. The frequency of this type of violation and the potential for severe consequences is a major reason for recommendations in a subsequent section that many of the circles be replaced by other traffic management devices.

STOP Controls

A range in driver obedience behavior is normally exhibited at a well-paced, well-marked STOP control. Most drivers stop fully or nearly fully although actually continuing an almost imperceptible forward motion. Another significant percentage of drivers maintain a somewhat faster rolling motion though believing they have come to a full stop. These two groups typically comprise about 90 percent of the drivers. The remaining drivers continue through the intersection at faster speeds ranging from an intentional non-stop slowing to a totally non-stop passage, usually the result of the driver not even seeing the STOP sign. That is to say, general expectation of "normal" behavior includes some percentage of "technical violations" and a small percentage (ten percent or less) of gross violations.

Driver obedience observations were conducted as a part of this study as part of the evaluation of STOP control installations. Three intersections were chosen to sample differences between intersections of varying travel characteristics. Gilman and Hopkins is a heavily utilized intersection where expectation of seeing other traffic is high. This intersection actually meets the warrants for a traffic signal. Expectation here would be for normal or better than normal obedience behavior. Acton at Cedar is a normal four legged intersection. Even though Cedar is the major a major street, Acton serves enough vehicles to make drivers on Cedar aware of the potential for cross traffic. Behavior approaching normal obedience might be anticipated here. Grizzly Peak at Muir Way and Stevenson is an example of a major street being stopped at very minor streets where the chances of meeting side traffic are remote. More violation than normal might be anticipated at this location.

The study for these three intersections recorded only vehicles which were not forced to stop because of the presence of conflicting vehicles -- that is, only those having the opportunity to violate. Study results are tabulated in Table 12.

Table 12
STOP SIGN OBEDIENCE - PROTOTYPICAL INTERSECTIONS

Intersection	Voluntary Stop	Roll 0-5 MPH	Glide 5-10 MPH	Fast Over 10 MPH
Gilman at Hopkins	7%	30%	60%	3%
Acton at Cedar	36%	26%	32%	6%
Grizzly Peak at Muir/Stevenson	2%	49%	40%	9%

Observations at the Gilman/Hopkins intersection show that the majority of the drivers continued through the intersection at speeds faster than what is ordinarily considered as a rolling stop. One reason for this is that the predominant traffic movement is southbound to westbound right turns and eastbound to northbound left turns which do not conflict with each other. The "T" intersection configuration with one leg serving noticeably less traffic seems to be a factor promoting violation of the STOP controls. However, the total percentage of serious violations is extremely high for any intersection, particularly one with this level of traffic activity.

Compliance to STOP sign control is noticeably better at Acton and Cedar, although the percentage of drivers violating at fast speeds is 100 percent higher than was reported at Gilman/Hopkins and serious violations are far higher than normal obedience behavior expectations. Good sight distance combined with Cedar serving as a through route are factors which probably promote the higher percentage of serious disobedience.

The observations of the intersection of Grizzly Peak Boulevard with Muir and Stevenson show almost no drivers making full legal stops. Roughly half the drivers make "rolling" stops while equal numbers pass through at faster speeds. Significantly, about nine percent of the drivers pass through the STOP controls at speeds over 10 MPH. In many of these violations, drivers pass through the intersection without any noticeable slowing from midblock speed. High speed violation at this location is three times as frequent as at the Gilman-Hopkins intersection and 1.5 times as frequent

frequent as at the Acton-Cedar intersection. The principal factor in flagrant and hazardous disobedience at this location is that drivers on Grizzly Peak Boulevard, which is a designated circulation system street, have almost no expectation of encountering conflicting traffic at this intersection. And further, they anticipate, probably correctly, that if the occasional conflicting vehicle is encountered here, it will probably defer to the major street traffic regardless of posted controls.

Additional obedience data obtained by the City documents driver behavior at other STOP sontrol locations is displayed in Tables 13 and 14.

Table 13
STOP SIGN OBEDIENCE -- BY SPEED RANGE

Location	Forced STOP	Voluntary STOP	Percentage Traveling		
			0-3 MPH	3-15 MPH	Over 15 MPH
Bowditch at Channing	32.9%	20.7%	37.8%	8.4%	0.2%
Eunice at Euclid	10.0	30.8	47.5	11.7	
Eunice at Spruce	22.7	21.6	38.0	15.8	1.9
Hillegass at Parker	10.0	11.0	48.0	27.0	4.0
LaLoma at Ridge	17.3	34.3	27.0	14.9	6.5
LeConte at LeRoy	14.6	13.4	48.5	20.4	3.0
LeConte/Scenic/Ridge	15.0	22.0	51.0	11.0	1.0

Table 14
STOP SIGN OBEDIENCE -- BY CLASSIFICATION

	Completely STOPPED	Rolling STOP	Fast Rolling STOP
Eunice at Spruce	8%	62%	30%
LeRoy at Ridge	14	80	6
LeRoy at Virginia	8	61	31
Los Angeles at Spruce	17	71	12

The results of these studies, documented in Tables 13 and 14, reinforce the general conclusion of the above analysis:

- Frequency of serious violations of STOP controls in Berkeley is far higher than the rate which might be considered normal.

- An alarming number of higher-speed violations (little attempt to slow or stop) are generally occurring at STOP controls in Berkeley with concentration of such violations at certain intersections.

This pattern of violations cannot be attributed to driver unfamiliarity with new STOPs or improper visibility and inadequate supplementary marking of the control devices. Most controls were in place several months before obedience observations were made and at locations of most flagrant violation, the character of traffic is local in nature -- most drivers observed pass through these intersections on a daily basis. Field inspections of new STOP installations have been made as part of this evaluation program. And, while numbers of opportunities for improvements in sign placements and supplementary markings are identified, deficiencies so severe as to cause the level of violation noted generally do not exist.

Deficiency in enforcement does not seem an appropriate causal explanation. The expectation of conflicting traffic normally conveyed to drivers by a STOP sign usually commands more obedience, regardless of enforcement stringency, than is manifest in Berkeley. So while STOP enforcement appears to be a fruitful area for increased efforts, deficiency in enforcement cannot be cited as the primary cause of flagrant STOP violations.

A primary cause of the high level of STOP violations experienced in Berkeley appears to be the character of many intersections at which STOP control has been placed and a related attitudinal response on the part of drivers. Many new STOPs deployed in the Traffic Management Plan were placed on arterial and collector streets primarily in an attempt to slow traffic or for purposes other than that of assigning right-of-way at a point where traffic conflicts make such assignment necessary. Regular drivers on arterials approaching STOPs at cross streets where there is remote prospect of cross traffic conflict know this and, in the absence of strong threat of enforcement, tend to violate the control. When such questionably justified STOPs are placed, not in isolated locations, but on a broad scale city-wide and at the same time as numbers of other devices frustrating to drivers, the natural result is marginal compliance and widespread deliberate violation. This reaction to STOPs appears to have become ingrained to the extent that numbers of drivers are violating not only the questionable devices but also many of those placed for substantive intersection control reasons.

The problem identified here is one which should not be ignored. Violations of this type and frequency are likely to lead to serious accidents though such accidents fortunately have not become prominent in experience to date. Tacit acceptance of violations seems sure to produce further obedience deterioration and eventually accidents.

Initiation of a campaign of strict STOP sign enforcement does not appear appropriate. This would require a high level of police manpower and would probably sharply increase public disenchantment with the entire Traffic Management Plan. The most appropriate approach appears to be that of removing STOPs on arterials and collectors which do not seem justified on the basis of intersection right-of-way assignment needs. Many of the most objectionable installations have already been removed. Selected additional removals plus some increase in enforcement would help normalize driver behavior at STOP controls.

STOP SIGN EFFECT ON SPEEDING

Traffic speed date were collected before and after Traffic Management Plan implementation on a limited number of streets where traffic speed has been a source of citizen complaint and on which STOP controls were deployed in an attempt to reduce speed. Table 15 presents "before" and "after" 85th percentile traffic speed statistics -- the speed at or below which 85 percent of all drivers travel on the given street.

The table indicates marginal reductions in the 85th percentile speed, the speed normally considered critical in such evaluations. The average reduction is about two miles per hour, not noticeable to the naked eye. Table 15 also presents changes in the maximum speed measured on these streets. No meaningful changes in maximum speeds are evidenced. In summary, the data shows that STOP controls in these locations are relatively ineffective as a speed control measure except in the immediate vicinity of the sign itself. Experience in other areas and observations on other streets in Berkeley indicate that this finding is generalizable to other streets on which STOP controls have been deployed primarily in an attempt to reduce traffic speeds. Selective speed enforcement on streets where speeding is noted as a problem would probably be more effective than use of STOP controls. Enforcement would not likely reduce 85th percentile speed much. There are problems obtaining convictions when a driver is cited for speeds above posted limits but at or below 85th percentile speed -- particularly when use of radar is involved. But enforcement could probably eliminate most of the travel above 85th percentile speed -- and this would address the speeding which is readily perceptible and of concern to residents. However, initiation of an expanded speed enforcement program is contingent upon allocation of resources and priorities to the Police Department. If speed control is to be undertaken, this would seem the most obvious recourse as speed control measures undertaken in the Traffic Management Plan have proven ineffective.

Table 15
STOP CONTROL EFFECTS ON SPEEDING

	Critical Speed (MPH)			Maximum Speed (MPH)			
				North or East		South or West	
Street	Before	After	Change	Before	After	Before	After
Cedar							
east of McGee	31.5	30.5	-1	40	38	38	36
west of Acton	31.5	29.5	-2	40	37	40	35
Rose							
west of Carlotta	31.5	30.1	-1.5	40	40	40	40
Spruce							
south of Eunice	36.0	34.0	-2	42	40	42	NA
south of Halkin	30.5	27.5	-3	36	32	38	35

ENERGY CONSUMPTION AND AIR QUALITY EFFECTS

Impacts of the Traffic Management Plan on energy consumption and air quality are difficult to assess in quantitative detail on the basis of data which can be assembled at this time. The Traffic Management Plan does cause some automobiles in Berkeley to travel further in reaching their destinations, to make more full stops, accelerations and decelerations, and to spend more time idling. All of these things do tend to increase pollution emissions and fuel consumption to some extent. However, there are a number of factors which tend to limit energy use and pollution emissions impacts of the Traffic Management Plan.

With regard to air quality and air pollution emissions, the conclusions of the City's environmental impact report on the Plan* prepared in October, 1974, appear to hold true. That is, air quality in the Bay Area, Berkeley as a whole, or on specific Berkeley streets is not meaningfully impacted by Neighborhood Traffic Management implementation. There are a number of reasons for this. One is the "cold start" effect. If an automobile has not been run for a few hours, within the first minute or two after starting it emits an extremely high percentage of the total pollutants it would produce on a trip of several miles. Hence, for most trips originating in Berkeley, the fact of starting up a car to drive it has far more significant impacts on pollution emissions than marginal changes in mileage driven or the characteristics of flow quality on city streets. Thus, the Traffic Management Plan has probably not caused meaningful increases in pollution emissions of those cars which are driven in Berkeley. And if the Plan has resulted in elimination of even a very small number of vehicle trips which would otherwise have been made, it may have resulted in a net reduction in overall pollutant emissions.

With regard to increases in concentrations of pollutants on individual streets caused by Traffic Management Plan induced traffic shifts, the following considerations should be noted. The principal auto emissions of concern in the Bay Area and in Berkeley are hydrocarbons (HC) and oxides of nitrogen (NOX). These exhaust products are not of concern in localized concentrations. They are transported through the air by the winds, react with each other in sunlight to produce photochemical smog. The fact of whether these smog producing incredients are emitted on one street or another in a city like Berkeley has no effect on the amount of smog people on one street or another will be subject to. The amount of smog experienced by people in Berkeley tends to be relatively uniform over the City and is determined by the amount and pattern of emissions in the entire Bay Region and the prevailing winds.

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*Environmental Impact Report, Berkeley Neighborhood Traffic Study, City of Berkeley, October, 1974.

Concentration and exposure to a third pollutant of concern, carbon monoxide (CO), is affected by the amount of traffic on individual streets and the level of congestion on them. Generally, CO concentrations are not a problem in Berkeley or the region. Calculations for potential worst-case situations performed in the City's environmental impact report on the Plan (op. cit.) showed maximum CO concentrations at worst-case sites were likely to be less than 25 to 40 percent of permissible exposure under Federal air quality standards. Nothing in the traffic volume changes which have eventuated since Plan implementation gives reason to question the findings presented in the Environmental Impact Report regarding CO. Traffic shifts induced by the Traffic Management Plan have not caused exposure to harmful CO concentrations anywhere in Berkeley.

In summary, the Traffic Management Plan probably has not caused any significant harmful change in emission of or exposure to motor vehicle generated air pollutants.

With regard to energy consumption, a slightly different situation prevails. There probably is some increase in gasoline consumption of those who continue to drive in the City, with those individuals most directly affected by traffic management controls incurring a large share of the cost of such increases. But overall, there may well be decreased gasoline consumption in Berkeley though the Traffic Management Plan's effect on this is unclear. In evaluating effects on energy use, the following factors need to be considered. Total change in mileage traveled on trips in or through Berkeley has probably been small. On a grid-like street system (the street system in the parts of Berkeley where nearly all the diverters are concentrated is a grid or grid-like) there are generally a number of routes of about equal distance between most origins and destinations. Hence, for most trips elimination of some route opportunities by diverters does not necessitate use of a longer (distance wise) one. And if a longer route is necessitated, normally only a block or two of added travel is involved. So overall travel distance and fuel consumption increases caused by diverter induced route shifts are likely to be small. A more important factor in energy consumption impact than forced changes in travel distance is that of changes in the overall flow characteristics of each trip -- the number of full stops, accelerations, decelerations, time at steady speeds and idling time. There is no way of realistically measuring or estimating the changes in these categories induced by the Traffic Management Plan or projecting gas consumption increases from this. Avaliable data relating gas consumption to "driving cycle" is now obsolete. It is highly probably more gasoline is consumed on motor vehicle trips now made in Berkeley than would be on those trips if the Traffic Management Plan were not in effect. But the difference is likely small. If the Traffic Management Plan has resulted in elimination of even a small percentage of auto trips which otherwise would have been made, energy savings from this could cancel the losses. But it is difficult to substantiate what effect, if any, Traffic Management has had on overall traffic in Berkeley.

In summary, the Traffic Management Plan probably has resulted in increases in gas consumption by individuals who continue to drive in Berkeley, but the total change is likely small. In any case, this is one of the negative factors which should be given consideration in evaluating the overall Plan.

EFFECT ON COMMUNITY SERVICES

The Traffic Management Plan has had a variety of impacts on community services which are in some way dependent on use of the street system in Berkeley. In a few cases, direct quantitative data substantiates these effects. In others, only speculative conclusions can be inferred on the basis of secondary data. In yet others, opinion of responsible officials is the only available basis for evaluations. While more substantive data would in many cases be desirable, the evaluations which follow reflect the best information which cna be assembled at this time.

Effect on AC Transit Operations*

Discussions with operating officials of AC Transit indicate that the Traffic Management Plan implementation has not had serious negative impact on transit operations in Berkeley. No regular routes on the system operate over street segments on which diverters, semi-diverters or traffic circles have been deployed. In at least one case, a route segment on the "dead-head" (out of service) portion of a school "tripper" (single daily operation for special purpose) run was blocked by a diverter. But this single bus operation was shifted without any particular inconvenience to the District and with absolutely no effect on the riders.

Auto travel time and congestion measurements conducted in this study which indicate minimal changes in travel time and tinersection delays over arterial and collector streets are generally confirmed by Transit District officials. They indicate that traffic shifts to the arterial and collector streets on which AC's buses operate has not materially affected ability to maintain on-schedule operations. A possible exception is on College Avenue where traffic shifts to that street initially caused increases in congestion levels and seemed to impede bus operations. The more recent reconstruction of the College/Ashby intersection has not only eliminated initial congestion increases attributable to traffic management, it has actually improved on the conditions which existed before traffic management implementation. Hence, problems noted initially by AC officials are probably not as prevalent currently. AC officials also noted that there is another factor not related to traffic management which may have contributed to the College Avenue schedule maintenance difficulties noted above. This is that significant ridership increases have occurred in the College Avenue corridor over the Rockridge BARTD Station to U.C. Campus segment. The increases in time requirements for boarding and alighting operations associated with the ridership increase appears to be responsible for a portion of the schedule maintenance difficulties experienced

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*This evaluation of Traffic Management effects on AC Transit operations has been prepared on the basis of informal conversations with Mr. Don Larson and supervisory officials in AC's transportation division. As such, it should be regarded as a general indicator of AC's experience and concerns and not as an official statement of policy on the part of the District.

in this corriodr. There is concern that diverters will make detours difficult when accidents, fires or other emergencies block regular transit routes. There is at least one instance where transit vehicles have had difficulty detouring around a fire site. The City should develop procedures which take advantage of the quick disassembly capabilities of bollard-based traffic management devices so that detour routes for transit vehicles and other traffic can be opened rapidly in the event of a major street blockage.

As for effects of the Traffic Management Plan on transit ridership, AC has experienced increases in ridership over the last year on lines in Berkeley. While it may be conjectured that the Traffic Management Plan has induced some people to use transit, it would be highly presumptious to conclude that Traffic Management is primarily responsible for the ridership increase. However, it is clear that the Traffic Management Plan has not hurt AC Transit patronage.

Overall, AC Transit officials are cautious in their assessment of the Traffic Management Plan's impacts upon the District's services in Berkeley. Implementations to date do not appear to have had any serious negative impact on operations or patronage. However, they continue to observe the situation in Berkeley carefully so that the District will have input on any new Traffic Management proposals which might negatively affect operations.

Police Services

Effects of the Traffic Management Plan on police services in Berkeley have been reviewed by J.R. Crooke, Acting Chief of Police. The following evaluation is based upon that review.

Available statistical data fails to show that the presence of traffic diverters or other traffic control devices placed in connection with this experimental program has any significant impact on overall police response time, the number of injury accidents reported to the police, or the number of major (index) offenses reported to the police. There are fluctuations in each category, but we are unable to attribute these normal monthly or seasonal changes to either the presence or absence of these traffic control devices.

Patrol officers and supervisors assigned to street duty perceive, and are almost certainly correct, that response time is affected in individual cases. But the absence of change in average response time data would seem to indicate that response time has somehow improved in other situations.

Specific perceptions and problems noted by police include:

- Almost total inability to travel northward from Ashby Avenue between Shattuck and Telegraph Avenues.

- There is increases diffuculty for patrol cars and emergency vehicles to move along main arterials that are now crowded, particularly during peak traffic hours. In addition, a major street blockage (collisions, fires, etc.) creates tremendous traffic delays as side streets often cannot be utilized as alternative traffic paths.

- Police operations are affected as it is very difficult to move "block covers" when a suspect is semi-contained in a block and then moves from one location to another. Many such cover plans rely on the use of the police vehicle. It is not uncommon to hear a radio response from a patrol officer to the effect that he cannot move directly to a particular assignment location because of a diverter.

- There is difficulty in pursuing persons on motorcycles, motor scooters, bicycles, and other similar conveyances that can easily slip through the diverters and elude a pursuing police vehicle.

- There may be a delayed response in an emergency situation because of the requirement to travel in a round about manner instead of a straight line. This is particularly true during peak periods of traffic when a direct route is complicated both by traffic diverters on side streets and by traffic on main arterials. In some emergency situations it has been necessary for officers to drive through emergency access diverters that are protected by a cement block placed to impede regular vehicle traffic. In six specific instances the bottom portion of the concerned police vehicle has been damaged, with repairs averaging approximately $100.00 to each car. In one widely reported instance which occurred on March 24, 1976, a mobile officer involved in the pursuit and subsequent arrest of a rape suspect also was forced to drive through an emergency access diverter and severely damaged the underside of his police vehicle. This incident occurred on Derby at Piedmont.

- There is an increased potential for collisions with pedestrians as vehicles driving around the circular islands must drive dangerously close to crosswalks and sidewalks and sidewalk corners.

- There is decreased patrol in "hard to get to" areas -- a prime example being the dead-end of Tanglewood.

- The sheer number and nature of new traffic controls implemented in the Traffic Management Plan, together with reduced police manpower makes adequate traffic enforcement virtually impossible. Apparent tacit approval of violations conveyed to motorists furthers the tendency to violations and increases accident potential.

Many of the above concerns of the patrol division are well-substantiated in fact. Others are matters of opinion but reflect very real actual or potential problems.

The overall evaluation of the Department is that they can, and do, live with the diverters. However, they feel there is no question that they inhibit police operations.

There are countermeasures to at least some of the above-cited problems which could be considered in the Traffic Management Plan evaluation. One is an increase in patrol division manpower. Placing more officers on the street would both reduce response time and increase capabilities for traffic enforcement as well as the general level of all types of law enforcement activities in the community. Higher levels of traffic enforcement might permit removal of the diverter undercarriage blocks without incurring increases in violations. Or police could be equipped with vehicles which clear the undercarriage blocks without difficulty.

Effects on Crime

Two theories have been advanced regarding relationship of crime to Neighborhood Traffic Management. One is that traffic management inhibits police operations and thereby leads to increases in crime. A second theory is that reduced street traffic increases neighborhood communication and awareness which tends to decrease crime. Because of these divergent theories, crime statistics for periods before and after Plan implementation are herein presented separately from the overall discussion of effects on police services.

Table 16 presents accident statistics for the fourth quarter of 1975 and the first quarter of 1976, the first two full quarters since Traffic Management implementation, along with statistics for the respective quarters a year previous -- before Plan implementation. Also shown on Table 16 is a summary for the full six month before and after periods.

Berkeley Police advise that the entire Bay Area experienced a decrease in crime in the first quarter of 1976 over 1975. They further advise that on July 1, 1975, a complete reorganization of the Patrol Division to achieve more effective crime prevention took place. Because of these complicating factors, it is difficult to infer what effect, if any, the Traffic Management Plan has had on crime levels in Berkeley.

Crime statistics for three selected Berkeley neighborhoods are compared on Table 17 for similar periods as the City-wide statistics above. It has not been possible to directly correlate crime incidence changes with changes related to the Traffic Management Plan. The talbe simply evidences the fact of quite differing types of changes in crime incidence in the three neighborhoods. Statistics from the table are graphically illustrated on Figure 5.

Table 16
CRIME STATISTICS: CITY-WIDE

Offense	Fourth Quarter		
	1974	1975	Percent Change
Homicide	7	3	-57%
Rape	24	23	-4%
Robbery	184	143	-22%
Aggravated Assault	95	116	+22%
Burglary	1254	1056	-16%
Larceny	1743	1871	+7%
Auto Theft	208	238	-14%
TOTAL	3515	3450	-2%

Offense	First Quarter		
	1975	1976	Percent Change
Homicide	4	3	-25%
Rape	28	27	-4%
Robbery	141	145	+3%
Aggravated Assault	86	89	+4%
Burglary	1109	895	-19%
Larceny	1718	1669	-3%
Auto Theft	154	167	+8%
TOTAL	3540	2995	-15%

Offense	Six-Months' Traffic Management Plan Period		
	Oct. 74 to April 1, 1975	Oct. 75 to April 1, 1976	Percent Change
Homicide	11	6	-45%
Rape	52	50	-4%
Robbery	325	288	-13%
Aggravated Assault	181	205	+13%
Burglary	2363	1951	-17%
Larceny	3461	3540	+2%
Auto Theft	362	405	+12%
TOTAL	7055	6445	-9%

Table 17
SELECTED NEIGHBORHOOD COMPARISONS

Offense	Last Qtr.74	Last Qtr.75	Percent Change	First Qtr.75	First Qtr.76	Percent Change
BATEMAN NEIGHBORHOOD (Census Tract #39)						
Homicide	0	1	+100%	0	0	0
Rape	0	0	0	1	0	-100%
Robbery	7	5	-29%	9	10	+10%
Aggravated Assault	8	5	-38%	4	1	+75%
Burglary	64	49	-23%	49	63	+29%
Larceny	77	87	+13%	82	70	-15%
Auto Theft	7	13	-86%	9	5	-44%
TOTAL	163	160	-2%	154	149	-3%
FLATLANDS NEIGHBORHOOD (Census Tract #30)						
Homicide	0	0	0	0	0	0
Rape	2	1	-50%	3	1	-67%
Robbery	7	5	-29%	14	4	-81%
Aggravated Assault	4	6	+50%	5	5	0
Burglary	53	53	0	40	46	+15%
Larceny	94	45	-52%	67	45	-33%
Auto Theft	9	9	0	6	9	+50%
TOTAL	169	119	-30%	135	110	-18%
LE CONTE NEIGHBORHOOD (Census Tracts #35 & #36)						
Homicide	0	0	0	0	0	0
Rape	4	1	-75%	3	1	-67%
Robbery	20	22	+10%	18	16	-11%
Aggravated Assault	10	2	-80%	3	6	+100%
Burglary	145	126	-13%	103	107	+4%
Larceny	207	269	+30%	232	282	+22%
Auto Theft	33	29	-12%	18	18	0
TOTAL	419	449	+7%	377	430	+14%

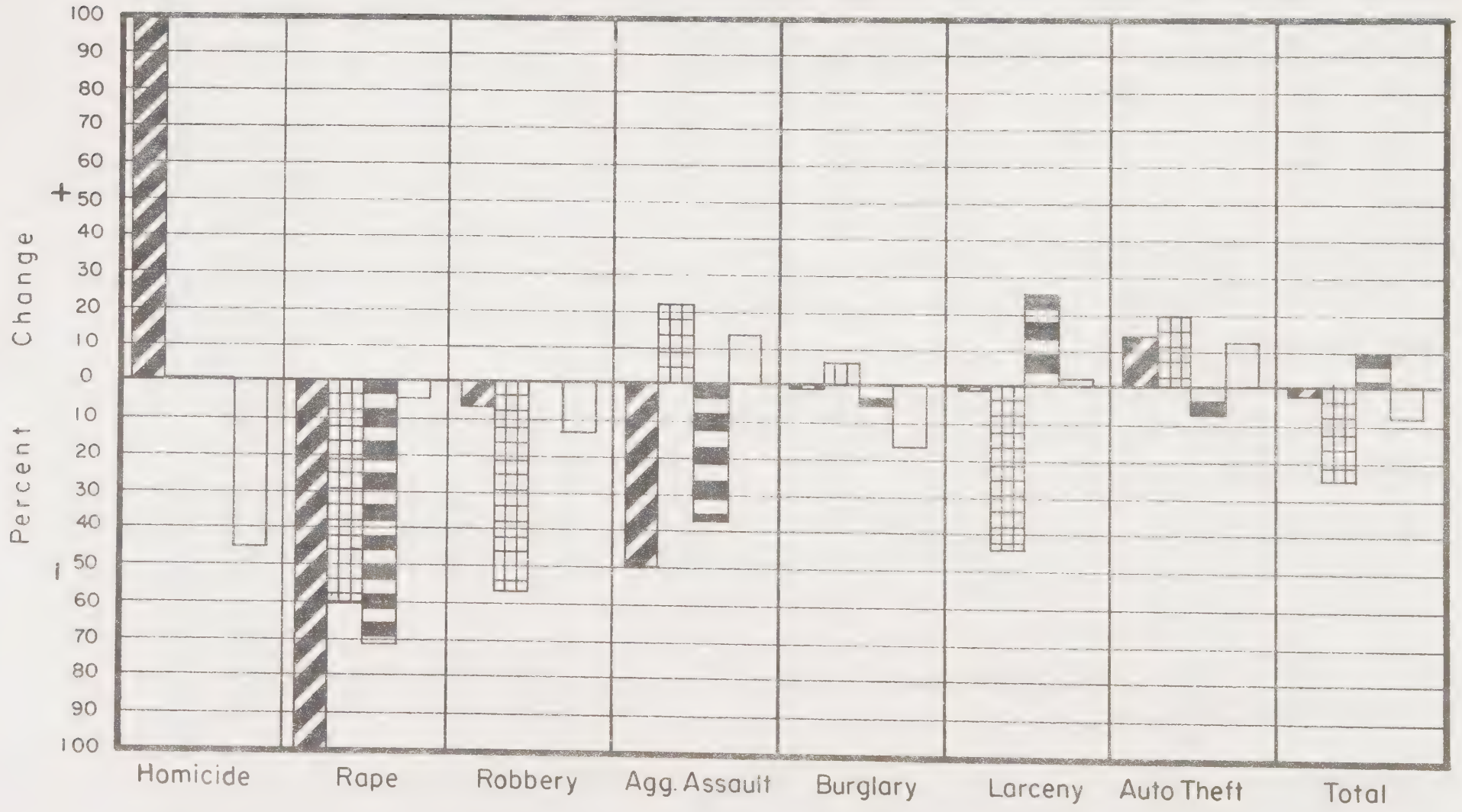
SIX MONTHS' NEIGHBORHOOD COMPARISON

Offense	BATEMAN Before	After	Change	FLATLANDS Before	After	Change	LE CONTE Before	After	Change
Homicide	0	1	+100%	0	0	0	0	0	0
Rape	1	0	-100%	5	2	-60%	7	2	-71%
Robbery	16	15	-6%	21	9	-57%	38	38	0
Aggravated Assault	12	6	-50%	9	11	+22%	13	8	-38%
Burglary	113	112	-1%	93	99	+7%	248	233	-6%
Larceny	159	157	-1%	161	90	-44%	439	551	+26%
Auto Theft	16	18	+13%	15	18	+20%	51	47	-8%
TOTAL	317	308	-2%	304	229	-25%	796	879	+10%

Figure 5

CRIME STATISTICS

Six Months Experience Oct. 75 - Apr. 76



School Transportation

Location and configuration of diverters in the Traffic Management Plan was done in coordination with Berkeley Unified School District officials and attempts were made to minimize disruption to school bus routes. However, some route revisions were necessary to continue pickups at some local street stops. These changes caused some additional route mileage and additional hours of work for drivers. The School District estimates, on the basis of preliminary budget review, that the added expense attributable to these route revisions is about $10,000 annually.

School Safety

No changes in the School Crossing Protection Plan have been made since Traffic Management Plan implementation. However, a complete revision of the crossing protection plan will be necessary during the summer of 1976 to take into account changes in attendance areas occasioned by school building earthquake safety rehabilitation work. The status of the Traffic Management Plan will have an important effect on priority ratings for adult crossing guards and school crossing flashers.

Refuse Collection

The Department of Public Works advises that refuse collection routes have been successfully revised to comply with changes in traffic control devices. The only change which has caused a noticeable problem is the one block long cul-de-sac on Tanglewood. Here the refuse collection vehicles must be driven in, then backed out the length of the block, an operation considered more hazardous than normal forward operations. No estimate of any cost impacts of the Plan on the refuse collection operation is available.

Street Maintenance

Deployment of traffic management devices has imposed new maintenance requirements on the Public Works Department. Public Works has prepared a summary of repairs performed on diverters, semi-diverters and circles from mid-July, 1975, when deployment was initiated through mid-January, 1976.

Repairs on diversion devices were performed in a total of 47 instances over this period. Significantly, two sites (Woolsey-Hillegass and Fulton-Blake) accounted for nearly two-thirds of all repair requirements. Cost of labor and equipment for these repairs is estimated at $6,700. Materials damage has been predominantly confined to the redwood boards used to link bollards. The boards are subject to considerable vandalism while no bollard received damage requiring its removal from service. Use of chains in place of the boards is under consideration.

GRAFFITI DEFACED SIGNS

STOLEN SIGNS SUCH AS THE MISSING KEEP RIGHT SIGN PREVIOUSLY ON THE TRAFFIC CIRCLE

DISLODGED BOLLARD FACILITATES TRAVEL THROUGH DIVERTER

RELOCATED BOLLARD WHICH CREATES A BYPASS AROUND A CLOSURE

REPAIR OF DAMAGED FACILITIES

STOP SIGN VISIBILITY

Fire

The Berkeley Fire Department's experience with the Traffic Management Plan has been reviewed by W.E. Pigman, Deputy Fire Chief. The following is a summary of that review.

The Fire Department has been and is concerned with any measure which might impede their efforts to protect life and property in Berkeley. In the Traffic Management Plan as adopted, a number of modifications were effected which make the plan more acceptable from a fire protection standpoint. Emergency access openings for high-carriage Fire Department vehicles have been provided in 16 full diverters.

Of course, this does not solve the entire problem because people do sometimes park cars illegally blocking the emergency access openings, and there are some full diverters that do not have emergency access openings. Fire Department low carriage vehicles (Chief Officer cars in particular) cannot use the emergency access openings.

There have been at least five emergencies where Fire Department operations have been adversely affected by diverters or by illegally parked cars blocking emergency access openings.

If the Traffic Management Plan is made permanent, additional fire hydrant installations will be recommended near some diverters.

In summary, the Fire Department feels there have been some impacts, or potential impacts, on fire protection which must be taken into consideration in evaluating the Traffic Management Plan.

If the Traffic Management Plan is continued, the traffic consultants suggest consideration of these measures to minimize potential interference with Fire Department operations:

- A comprehensive study of City-wide fire hydrant needs and installation of new hydrants as determined necessary.
- Strict enforcement of parking restrictions in the vicinity of diverters.
- Equipping Chief Officers with vehicles capable of clearing under-carriage barriers.
- Requirements for installation of smoke and/or heat detectors in all buildings in Berkeley so that early fire detection may offset any increases in response time.

FIELD EVALUATION OF TRAFFIC MANAGEMENT DEVICES

Traffic control devices installed as part of the Berkeley Traffic Management Plan (as amended to February 1976) were reviewed on-site during April 1976. Vairous traffic engineering features were inventoried and comments recorded where modifications should be made. Decumentation of this information is grouped by thpe of control device. The devices described in the following paragraphs include traffic circles, semi-diverters, diverters, closures, STOP signs and miscellaneous treatments.

Traffic Circles

The basic concept of a traffic circle within the context of the Traffic Management Plan is to provide a device less restrictive than a diverter or closure. Circles are intended to reduce traffic speed and hopefully traffic volume. A typical traffic circle installation at an intersection should have the following features:

- The device should be clearly visible to approaching drivers and require traffic to deviate somewhat from its normal travel path.
- KEEP RIGHT signs should be placed facing approaching drivers on all approaches.
- Centerlines should be delineated on each approach to direct travel around the circle.
- Parking restrictions (red curb) should be placed adjacent to the circle to facilitate travel and to minimize conflicts with parked vehicles.
- Crosswalks and STOP bars should be located beyond the influence of traffic traveling around the circle.

Three types of "circles" have been employed in the Traffic Management Plan. In the "linked star" type, bollards are linked by boards to form a cross. In the "open star" type, the linking boards are omitted. In the corral type, bollards are linked by boards to enclose a space. No particular difference in functional performance of the three types was noted. However, it is desirable that all types of traffic circles are recognizable from a distance rather than being totally dissimilar and possibly confusing to approaching drivers.

Some 15 traffic circles have been installed as part of the Traffic Management Plan. Fourteen of these are at intersections and one is at a midblock location. Eleven of these new traffic circle sites are controlled by STOP or YIELD signs. Two of these have 4-way STOP control. The following general observations of the traffic circles were noted during field inspections:

- No direct data measurements on "before" and "after" speeds on streets with traffic circles have been made in this evaluation program. However, observations indicate many drivers do not slow down at the traffic circle, especially when traveling straight through the intersection. This is particularly true when one street is much more heavily traveled than the other and motorists on the busier street have little expectation of conflicting cross-street traffic.

- Shortcutting is quite evident for left turns. Vehicles are driven on the wrong side of the circle to complete the turning maneuver.

- Some crosswalks and STOP bars are located such that vehicles traveling around the circle present a potential hazard to pedestrians and to other vehicles waiting at a STOP sign.

- Where parking is heavy, some Red Zones (NO PARKING) are violated. This unduly restricts sight distance and travel around the circle. Some residents complained of parked cars being sideswiped.

- Where parking in infrequently utilized the traffic circle does not prevent drivers from maintaining their speeds by flattening their angles of appraoch by driving close to the curb.

- Driver confusion occurs at sites where a circle is placed at an offset intersection such as at Derby and Hillegass. Left-turns from one approach logically turn before reaching the circle, although whether this is permitted or not is ambiguous. Left-turns from other approaches are expected to travel around the circle.

On the basis of field observations and review of traffic count data, it is out judgment that many of the circles should be removed or replaced by other traffic management devices. Many of these circles seem to be ineffective as speed control devices (although no radar speed studies have been done on circle-controlled streets). The combination of driver behavior and site configuration at some diverter locations appears to create a very high accident potential. And circles appear to have had only limited success in discouraging traffic use of the streets on which they are deployed.

This last point merits additional discussion. Limited availabel traffic count data indicates small changes in daily traffic have occurred on streets in the vicinity of traffic circles. But whether the changes have been caused by the circles or by diverters in other areas is a matter of speculation. Circles do create a definite image of the presence of special neighborhood traffic control devices. They can be seen by drivers contemplating turning into a neighborhood from a bordering through street and at a distance taken for a diverter. This image may be enough to divert some unfamiliar drivers who think the street blocked or fear getting lost in a maze, even though circles do allow through travel.

Table 18
TRAFFIC CIRCLE EVALUATION

Location	Type of Circle (1)	Number of Bollards	Recommendation		Existing Intersection Control	Comments
			Retain	Replace (2)		
Allston at California	Linked Star	4		X	2-Way STOP	Remove SLOW SCHOOL XING marking on south leg.
Bancroft at Bonar	Linked Star	4		X	2-Way STOP	If retained, adjust centerline on Bancroft and stripe centerline on Bonar. Paint STOP bars on Bonar.
Bancroft at California	Linked Star	4		X	2-Way STOP	If retained, paint STOP lines on California.
Bancroft at Grant	Linked Star	4		X	2-Way STOP	If retained, adjust centerline on Bancroft and stripe centerline on Grant.
Benvenue at Derby	Corral	3		X	2-Way YIELD	Add centerline striping on Derby. Replace YIELD signs and markings with STOP signs and markings.
Benvenue at Parker	Corral	5	X		2-Way STOP	Add KEEP RIGHT signs for EB/WB travel. Stripe centerlines.
Channing at Curtis	Linked Star	4		X	15 MPH Markings	Consider 2-Way STOP.
Derby at Hillegas	Corral	3		X	4-Way STOP	Remove circle and retain 4-Way STOP. Stripe center and STOP BARS ON Hillegass.
Ensenada at Portland	Linked Star	4		X	2-Way STOP	If retained, stripe centerline on approaches.
Eton at Woolsey	Corral	5		X	None	If retained, stripe centerline on approaches and replace arrow signs (W-57) with KEEP RIGHT signs.
Hearst at Tenth	Corral	6	X		2-Way STOP	
Hillegass at Parker	Linked Star	4	X		4-Way STOP	Add KEEP RIGHT signs for EB/SB/WB travel. Remove both STOP signs on one street or circle is redundant.
Hillegass at Stuart	Linked Star	4	X		2-Way STOP	Add KEEP RIGHT signs for NB/SB travel. Stripe centerline on Hillegass.
Nelson at San Lorenzo	Linked Star	4		X	None	If retained, stripe centerline on approaches and make 2-Way STOP on Nelson.
Prince between College and Claremont (midblock)	Open Star	4		X	None	If retained, stripe centerline and also consider placing one more bollard at each exit along curb to protect parked cars.

(1) Type of Circle - Definition: Linked Star includes bollards connected by boards to form a cross.
Open Star includes bollard placement only (without board).
Corral includes bollards connected by boards to enclose a space such as a square.

(2) Recommendation to retain or replace a circle is based upon observed traffic flow characteristics and geometrics.

TRAFFIC CIRCLES

BOLLARD STAR MIDBLOCK TREATMENT

LINKED BOLLARD STAR --
INTERSECTION TREATMENT

LINKED BOLLARD CORRAL --
INTERSECTION TREATMENT

Table 18 presents an inventory of and recommendations regarding disposition of all traffic circles. Retainage of four of the 15 new traffic circles is recommended. For the four to be retained (and the others, if the replacement recommendations are not carried out) suggestions for improvements are also included on Table 18.

Semi-Diverters

A semi-diverter is a physical barrier which allows travel in one direction while prohibiting travel in the other direction. Since a semi-diverter has a usable opening, two-way access is possible for emergency vehicles. A typical semi-diverter installation should have the following features:

- It should restrict vehicular access to one side of the street either by a physical barrier or merely by a sign prohibiting travel in one direction.

- DO NOT ENTER signs should face drivers in the forbidden direction of travel.

- Centerlines at the physical barrier are helpful to clearly define lane usage.

- Arrow pavement markings may also be utilized to emphasize direction of travel through a semi-diverter, thereby inhibiting some of the potential violators.

A number of pre-Traffic Management Plan semi-diverters, usually constructed of guard-rail, are employed at various locations in the City. These were not addressed in the field inspection. All the new semi-diverters deployed in the Traffic Management Plan are made of bollards. Three of these installations are comprised solely of bollards, while the remaining 12 installations combine bollards linked with boards.

Following are some general characteristics of semi-diverters performance in Berkeley:

- While many drivers do not enter a street protected by a semi-diverter, "regular" users oftentimes continue to drive through in the wrong direction.

- Semi-diverters at an intersection with a major street appear to be more effective than those located further within a neighborhood. One reason for this is that a semi-diverter within a neighborhood may trap drivers who have already committed themselves to a direction of travel, and a change proves to be physically awkward and disturbing.

The semi-diverter which we observed being violated the most frequently during our field reivew was the one located on Fresno about 300 feet south of Solano. Local shoppers appear to be heavy users of the street.

Table 19
SEMI-DIVERTER EVALUATION

Location	Type	Existing Intersection Control	Comments
Alcatraz at Lewiston	Linked Bollard (2)	1-Way STOP	
Ashby at Lorina	Linked Bollard (2)	1-Way STOP	
Ashby at Wheeler	Linked Bollard (2)	2-Way STOP	
Benvenue at Webster (West)	Linked Bollard (2)	2-Way YIELD	Stripe centerline around curve. Remove YIELD signs and markings and replace with STOP signs and markings for NB and EB drivers exiting semi-diverters. All bollards painted pastel colors. Install curve signs W-3 (RT) and W-3 (LT) facing WB and SB drivers respectively.
Benvenue at Webster (South)	Linked Bollard (2)	2-Way YIELD	Same intersection as above.
Cedar at Milvia	Bollard (3)	4-Way STOP	
College at Prince	Linked Bollard (2)	1-Way STOP	Replace obsolete DO NOT ENTER signs.
Dana at Dwight	Linked Bollard (2)	Signal	
Domingo at Hazel	Bollard (2)	1-Way STOP	Remove SLOW SCHOOL XING pavement marking on west leg.
Fresno 300' South of Solano	Bollard (3)	None	Install W-53 near Solano facing drivers entering Fresno.
Halcyon Ct. at Prince	Linked Bollard (2)	None	
Russell at Wheeler	Linked Bollard (2)	None	Replace obsolete DO NOT ENTER sign. Install W-53 facing drivers entering EB Russell at Shattuck.
Tunnel Road at The Uplands	Linked Bollard (2)	None	Replace obsolete NO LEFT TURN signs. Left and U-Turn violations can be stopped by continuing the Tunnel Road median westward to physically block these maneuvers.
Webster 200' East of College	Linked Bollard (2)	None	
Webster 200' West of Telegraph	Linked Bollard (2)	None	

BASIC BOLLARD

LINKED BOLLARD WITH FLOWER BOX

GUARD RAIL

While potential for violation is a factor inherent in the semi-diverter design, most of the installations have been reasonably effective. However, there are several locations where a semi-diverter may not be required at all. These sites include Alcatraz at Lewiston, Halycon Court at Prince and Russell at Wheeler. The inventory of the 15 new semi-diverter sites and comments for their improvement are shown in Table 19.

Diverters

A diverter is a form of traffic control device most typically employed diagonally across an intersection to impose a curvilinear street pattern on a rectangular street grid. Installations can be designed to require all traffic to turn or to allow emergency access through a gap. Typical diverter installations should possess the following basis features:

- Head-on visibility to approaching drivers. This can be achieved by diverter design as well as provision of supplemental signing indicating direction of travel and reflectors to enhance nighttime visibility.

- Centerline striping on all approaches.

- Centerline striping around the curve to indicate proper travel lane relationships.

Some 17 diverters are identified on the Traffic Management Plan map. Of these, six are pre-Traffic Management Plan constructed of guard-rail; four other pre-Traffic Management Plan diverters involve complete intersection reconstruction with curb and gutter and landscaping; five are constructed of bollards with gaps for emergency vehicle access. Three installations have center gaps and two have gaps positioned toward one side of the installation. In each case a concrete undercarriage device is positioned in the gap to pervent wholesale violations. The general characteristics of the diverter installations reviewed can be summarized as follows:

- Diverters are effective in changing traffic flow in an area.

- There is a potential for violations at full diverters where sidewalk areas are wide enough to provide an accessible bypass. Many of the sidewalk areas have already been treated to prevent this phenomenon. The full diverter at Parker and Piedmont is one location where additional steps are required to prevent vehicles being driven over the sidewalk on the northeast corner to bypass the diverter.

- All of the diverters providing a gap for emergency access are violated to some degree. Some strangers are brave enough to "test" the effectiveness of the undercarriage devices and certain "familiar" drivers driving higher-slung vehicles or having perfected other techniques violate the "protected" gaps with confident regularity. But the undercarriage blocks do dissuade or prevent violations by most motorists.

Table 20
DIVERTER EVALUATION

Location	Diverter Device(1)	Type		Under-Carriage Device	Comments
		Full	Gap		
Acton at Virginia	Guard Rail	X		-	
Acton at Ward	Landscaped	X		-	15 MPH markings missing on Ward.
Ada at California	Linked Bollard (8)	X		-	Realign bollards to make more effective. Stripe center lines.
Bancroft at Seventh	Guard Rail	X		-	Remove SLOW SCHOOL XING marking on west leg.
Berkeley Way at Grant	Linked Bollard (6)		Side	Block	Stripe centerlines and around curve.
Blake at Fulton	Linked Bollard (4)		Side	3 Blocks	
California at Oregon	Guard Rail	X		-	Curve sign W-3 (RT) missing from west leg. Curve sign on east leg obscured by tree. Consider moving sign eastward.
Channing at Ninth	Guard Rail	X		-	
Channing at Roosevelt	Linked Bollard (5)	X		-	Curve sign W-3 (LT) and 15 MPH sign missing on west leg. Curve signs on north and east legs obscured by trees. Relocate signs.
Delaware at Ninth	Guard Rail	X		-	
Derby at Mabel	Landscaped	X		-	15 MPH marking only on west leg.
Derby at Piedmont	Linked Bollard (5)		Center	Block	Remove choker and STOP signs on Piedmont. Stripe centerline around curve.
Matthews at Parker	Landscaped	X		-	
McGee at Virginia	Guard Rail	X		-	One arrow sign W-56 bent. W-3 reflector signs missing or dislodged.
Milvia at Yolo	Bollard (7)	X		-	Bollard on SW corner moved to allow passage. Stripe centerlines and around curve.
Park at Russell	Landscaped	X			Prune trees obscuring advance curve warning signs.
Parker at Piedmont	Bollard (8)		Center	Block	Stripe centerline and around curve. Add one more Bollard to prevent sidewalk bypass over NE corner.

(1) Diverter Device - Definition: Bollard includes bollard placement (without connecting boards)
Linked Bollard includes bollards connected by boards guard rail utilize guard rail.
Landscaped includes a landscaped curbed area.

The number in parentheses is the number of bollards used.

GUARD RAIL

LINKED BOLLARD

LINKED BOLLARD WITH PROTECTED EMERGENCY ACCESS GAP

- Bicyclists and occasionally pedestrians can also be found utilizing the gaps in diverters. The original intent in diverter planning was that bicyclists should not be diverted with motor vehicle traffic but should be provided some sort of passage.

- Advance warning signs posted along the side of the street are or become obscured by trees in many cases. However, the directional curve signs placed at the diverter in a head-on position are clearly visible.

- Variations in signing and striping from one installation to another present a inconsistent image to approaching drivers trying to understand their responsibilities.

- The white aggregate bollards appear highly visible at night, however, additional reflectors are needed on the boards linking bollards. A variety of methods have been utilized including installing individual reflectors and placing reflectorized tape. Vandalism seems to have detracted from efforts to provide satisfactory reflectorization. Placement of reflectors on the bollards themselves may improve diverter visibility. The "undercarriage preventer" blocks are less visible at night than are the bollards. These blocks should be painted with white paint and equipped with reflectors or reflective beads mixed in the paint.

- Bollard alignment is occasionally such that the travel lanes are unduly restricted and a disorderly image is presented to the approaching driver. The installation at Ada and California is a case in point.

Of all of the diverters reviewed, the installation at Milvia and Yolo appears to be the least needed, and we recommend consideration of alternatives such as centerline striping and STOP signs. Diverter inventory and comments are summarized on Table 20.

Closures

A closure is a traffic management device most frequently positioned at the end of a street intended to create a cul-de-sac effect. Some installations are designed with provisions for emergency access. Typical closure installations should possess the following features:

- Head-on visibility to approaching drivers. This can be achieved by physical design -- the image of horizontal and vertical elements, provision of reflectors and location under street lighting to improve night visibility.

- Advance warning signs indicating that the street ahead is "NOT A THROUGH STREET."

- Adequate space at the closure to facilitate vehicle turn around. This is typically provided by adopting No Parking zones.

- DO NOT ENTER signs placed where emergency access gaps are provided.

- Overhead lighting from nearby street lights is also a valuable asset to provide increased visibility.

There are 31 locations where closures have been implemented in the Traffic Management Plan. Of these, 22 utilize bollards or bollards and boards exclusively. Three closures are landscaped and curbed; two sites are closed with chain link fence; steel posts are utilized at two locations; one closure is constructed with wooden posts and one treatment combines steel posts with bollards.

There are 13 closures which provide special emergency access. Of these, nine have the gaps protected by undercarriage devices; three remain open without a physical barrier to prevent passage and the one, into the City corporation yard, is more a form of directional channelization than a closure. The general characteristics of the closure installations reviewed can be summarized as follows:

- Closures are effective in changing traffic flow through an area.

- There is a potential for violation at a full closure where sidewalk area are wide enough to provide an accessible by-pass. Many of the sidewalk areas have already been treated to prevent violations from occurring. However, the bollard closure of Napa at The Alameda is an example where additional steps are required to prevent vehicles being driven over the sidewalk on the southwest corner.

- All closures with gaps for emergency access are violated to some degree for similar reasons as diverter gaps. Violation of the closure of Russell at Milvia is a special case where most violating drivers simply by-pass the closure by utilizing a well worn path through a vacant lot on the south side of the closure.

The closure of Tanglewood at Belrose/Derby is effective. However, if an agreement with the City of Oakland could be reached to place a semi-diverter to prevent vehicles entering Tanglewood from Claremont, then the closure at Belrose/Derby could be removed. This alternate scheme will work since eastbound traffic on Derby now must turn right as a result of recent channelization, and it will also provide a less encumbered access for residents along Tanglewood. The closures of Bonita at Hearst and of Russell at Milvia are two installations that we believe could be removed without causing problems. This is true especially of the closure of Bonita.

Table 21
STREET CLOSURE EVALUATION

Location	Closure Device (1)	Type		Under-Carriage Device	Existing Intersection Control	Comments
		Full	Gap			
Acton at Francisco	Landscaped	X		-	None	
Allston at Eighth	Fence/Steel Posts	X		-	1-Way STOP	Arrow sign W-56 on fence would be helpful facing SB drivers.
Allston at Corp.Yard	Bollard (4)/ Traffic Bars		Side	Channel-ization	2-Way STOP	Warning signs at Bonar and at Sacramento discourages some traffic. "Closure" freely violated.
Ashby at Deakin	Linked Bollard (3)	X		-	1-Way STOP	
Ashby at Ellsworth	Linked Bollard (3)	X		-	None	Install W-3 reflector sign facing drivers in southbound lane.
Ashby at Fulton	Linked Bollard (4)		Center	Pipe	Signal	Replace obsolete NO LEFT TURN signs on Ashby.
Avalon at Claremont	Linked Bollard (2)	X		-	None	Several reflectors missing on W-31 sign.
Bateman at Webster	Linked Bollard (4)		Center	Open	None	Three bollards painted pastel colors. Freely violated.
Belrose/Derby/Tanglewood	Bollard (5)	X		-	None	Continue centerline on Derby around curve to island. Replace SLOW sign on Belrose with CURVE sign W-3.
Blake at Milvia	Linked Bollard (4)		Center	Block	2-Way STOP	A W-56 arrow warning sign on the closure facing SB drivers may be helpful.
Bonita at Hearst	Bollard (5)	X		-	1-Way STOP	Paint centerline and STOP bar on south leg. Install W-56 arrow sign at closure facing NB drivers.
Cedar at Grant	Linked Bollard (3)	X		-	1-Way STOP	Install W-56 arrow sign on closure facing SB drivers. Paint centerline and STOP bar on north leg.
California at Hearst	Steel Pipe	X		-	1-Way STOP	Repaint posts white. Install W-51 arrow sign facing NB drivers and W-3 sign to replace obsolete sign on north approach.
Claremont/Garber/Oakhill	Linked Bollard(4)/ Steel Post	X		-	None	
Claremont at Webster	Linked Bollard (4)		Center	Open	None	
Colby at Regent	Linked Bollard (4)		Center	Open	None	Replace obsolete DO NOT ENTER signs.
Colby west of Regent	Wooden Posts	X		-	None	Continue centerline around curve.
Dana at Webster	Linked Bollard (4)		Center	Block	None	Replace one obsolete DO NOT ENTER sign.
Delaware at Sacramento	Fence	X		-	Signal	Fence damaged on easterly approach. Replace obsolete DO NOT ENTER sign.
Delaware at Short	Landscaped	X		-	None	
Dwight at Ellsworth	Linked Bollard (4)		Center	BLock	Signal	Install DO NOT ENTER sign facing SB drivers
Dwight at Etna	Linked Bollard (4)		Center	Block	1-Way STOP	Replace broken undercarriage device.
Garber at Tanglewood	Bollard (3)	X		-	None	Relocate W-53 sign on Tanglewood closer to Claremont

Table 21
STREET CLOSURE EVALUATION (Continued)

Location	Closure Device (1)	Type		Under-Carriage Device	Existing Intersection Control	Comments
		Full	Gap			
Hillegass at Woolsey	Linked Bollard (4)		Center	Pipe	None	Replace obsolete DO NOT ENTER sign. Stripe centerline around curve. Install W-3 signs on each approach.
Kelsey at Palm	Linked Bollard (3)	X		-	None	
Milvia at Russell	Linked Bollard (4)		Center	Pipe	1-Way YIELD	Replace missing YIELD sign. Violators use vacant lot as bypass around closure so install additional bollards.
Piedmont at Russell	Linked Bollard (5)		Center	Block	None	Gate arm missing. Relocate W-53 sign on Russell closer to College. Install RIGHT TURN ONLY sign facing NB drivers. Stripe centerline around curve.
Napa at The Alameda	Bollard (5)	X		-	None	Reposition southerly bollard to close gap where drivers travel over sidewalk. Consider post near sidewalk.
Short at Virginia	Landscaped	X		-	None	
Walker at Ward	Sign Post	X		-	None	Replace sign post with more aesthetic closure.
Wheeler at Woolsey	Linked Bollard (5)		Center	Pipe	None	Remove centerline extending thru closure. Paint centerline around curve. Install W-53 sign facing drivers entering Woolsey at Shattuck.

Closure Device - Definition: Bollard includes bollards placement (without connecting boards)
Linked Bollard includes bollards connected by boards.
Landscaped includes a landscaped curbed area.
Fence includes chain link fence.
Steel or wood post are self descriptive.
Number in parenthesis is number of bollards used.

CLOSURES

FULL CLOSURE WITH BOLLARDS

FULL CLOSURE WITH
LINKED BOLLARDS

BOLLARD CLOSURE WITH PROTECTED
EMERGENCY ACCESS GAP

LINKED BOLLARD CLOSURE WITH
PROTECTED EMERGENCY ACCESS GAP

LINKED BOLLARD CLOSURE WITH
OPEN EMERGENCY ACCESS GAP

LANDSCAPED CLOSURE

The channelization "closure" of Allston at the corporation yard is freely violated. A revised design will be necessary if better compliance is to be achieved. The advance signs at Bonar and at Sacramento warning of the closure several blocks ahead may be effective in deterring unfamiliar drivers but are of no value in changing the travel pattern of "regulars" who have learned that the "closure" can be easily violated. The inventory and comments relating to closures are summarized on Table 21.

STOP Signs

STOP sign control commands drivers to stop, typically to reduce conflicts between crossing vehicles or with pedestrians. It may be used to assign one street priority over another, to assign sequential right-of-way or at intersections having restricted sight distance. While installing a STOP sign is a relatively easy task, care must be taken to assure the location is appropriate both from the site characteristics and system relationships.

Some 153 locations presently have one or more STOP signs installed as part of the Traffic Management Plan. The installations have created 14 one-way STOPs, 67 two-way STOPs, 11 three-way STOPs, 59 four-way STOPs and two five-way STOPs. While some of these locations were controlled by YIELD signs or by a lesser number of STOP signs, many installations were placed at previously uncontrolled intersections. The general characteristics of STOP sign installations reviewed in the field can be summarized as follows:

- There are a large number of striping and pavement marking combinations in use with STOP signs in Berkeley which make the STOP sign itself the only consistent feature of a STOP sign installation. While a variety of markings are appropriate to differing site conditions, there are a number of locations at which more consistent marking treatments are desirable both in the context of the individual site and of the corridor in which the site is located.

- There are many STOP signs which are obscured to various degrees by trees and branches. While some of the problems are caused by mature growth, by far the most alarming potentials are created by relatively new trees planted between the sidewalk and the curb. The main leafy growth of many of the small trees is about the same height as a STOP sign, so sign visibility problems are inevitable. Relocation or removal has been recommended in some cases and pruning in others. While pruning must be a continuing maintenance feature, problems may lessen somewhat as the trees become larger and the leafy growth occurs above the STOP sign.

- Location of STOP signs is critical at several intersections where sight distance is restricted by mature trees or utility poles which cannot be readily moved. In such cases, consideration should be given to placing the STOP sign in front of the obstruction even if the sign must be moved somewhat further away from the intersection than is normal practice. In addition, STOP bars, centerline and even STOP pavement

markings will be required to remind the driver of the correct stop position at the intersection. Another alternative would be to construct a choker so the STOP sign can be placed in a clearly visible location. Whatever the solution, STOP sign visibility must be maximized.

- While most of the STOP signs inspected displayed no evidence of vandalism, vandalism potential remains a continuing problem.

- Lack of driver obedience to STOP signs appears to be a problem at many of the intersections reviewed. (STOP sign obedience is described in more detail in another section of this report.

Installation of STOP controls at some 153 intersections has been a massive undertaking. Review and upgrading of supplementary intersection markings at these locations is now needed. This includes modification or removal of vestigial pre-traffic management markings and achievement of generally consistent marking treatments at individual intersections and at successive STOP controls within a corridor.

Inventory of the 153 new STOP sign installations is contained in Table 22. Comments are largely related to improvements of visibility and clarity. Some recommendations regarding marking changes are also included.

Some STOP sign installations originally installed as part of the Traffic Management Plan proved to be so unrealistic and created such problems that they have been removed. The most recent example is the removal of STOP signs controlling Spruce at Northampton and at Michigan. There are still other sites where we believe STOP signs are an unsatisfactory solution. For instance, the offset geometrics, extremely low cross street traffic and consistent hazardous violations make the intersection of Grizzly Peak with Muir Way and Stevenson a prime candidate for early removal of STOP signs controlling Grizzly Peak.

Various traffic control devices listed on the Traffic Management Plan map (as amended to to February 1976) have not been implemented or have been removed or revised. A summary of these revisions is found in Table 23.

Miscellaneous Treatments

Turn restrictions and traffic signals were also included in the Traffic Management Plan. Comments with regard to specific improvements are presented in the following paragraphs:

- Kittredge at Oxford
  Restrictions disallowing U-turns between 7 AM - 9 AM and between 4 PM - 6PM are installed on Oxford. Left-turn restrictions should be imposed for Kittredge since these turns conflict directly with the heavily utilized pedestrian crossing.

- Fulton at Dwight
  Even though Fulton serves two-way traffic south of Dwight, turn restrictions require southbound traffic to turn left onto eastbound Dwight. To make this fact clearer to all drivers, the LEFT TURN ONLY sign R-59 (LT) should be relocated from the left side of Fulton where it is obscured by a utility pole to a more visible location to augment the existing directional arrow pavement markings. Consideration should be given to placing another R-59 (LT) sign on the right side of Fulton. These advance signs combined with a sign in the head-on position would be the ideal configuration.

- Colusa at Tacoma
  The existing SLOW SCHOOL XING pavement marking painted on the north leg of Colusa should be removed. It is no longer necessary since a new traffic signal has been installed.

- Colby at Ashby
  The pavement marking on northbound Colby can be improved by revising the two straight directional arrows to one arrow indicating a left-turn and one arrow indicating a right-turn onto Ashby. In addition, a dashed line through the intersection would be very helpful for westbound drivers turning from the left turn lane on Ashby onto Colby. Presently there is a tendency for left-turning drivers to cut the corner and conflict with the westerly exiting lane. The recommended guidance line would help to reduce conflict potential by emphasizing spacial relationships.

Table 22
STOP SIGN EVALUATION

Location	Stop Signs (a) N S E W	All-way Signs	Stop Bar N S E W	Centerline (b) N S E W	Cross-walk (c) N S E W	Pavement Markings N S E W	Comments
Acton at Bancroft	4 4 4 4	-	- - X X	- - S S	- - - -	- - - -	Paint STOP bars and centerline on Acton. Prune palm trees on east leg.
Acton at Blake	- - 2 2	-	- - X X	S S S S	- - - -	- - RR RR	Confusion with close spacing of STOP bars and RR crossing limit lines. Paint STOP message at STOP bar to clarify.
Acton at Carlton	2 2 - -	-	- - - -	- - - -	- - - -	- - - -	-
Acton at Delaware	4 4 4 4	None	- - X -	Dbl Dbl Dbl Dbl	W W - W	- Stop Stop Stop	Paint STOP marking on north leg.
Acton at Rose	4 4 4 4	None	- - - -	- - S S	Y Y Y Y	- - - -	Remove SLOW SCHOOL XING marking in south leg. Relocate SCHOOL sign on west leg to east leg since it obscures STOP sign.
Acton at 66th	1 - - -	-	- - - -	- - - -	- - - -	- - - -	-
Addison at 7th	- - 2 2	-	- - - X	S S - -	W W - W	- - Stop Stop	-
Addison at 8th	2 2 - -	-	X X - -	S S - -	- - - -	- - - -	-
Addison at 9th	- - 2 2	-	- - X X	S S - -	- - - -	- - - -	-
Addison at 10th	2 2 - -	-	- - - -	- S - -	W W W W	- - - -	Prune small tree on north leg.
Addison at California	4 4 4 4	Yes	X - - X	Dbl Dbl Dbl Dbl	- Y Y -	- - - -	-
Addison at Grant	4 4 4 4	None	- - - -	- - - -	W W W W	Stop Stop - -	Prune small tree on west leg.
Addison at McGee	- - 2 2	-	- - X X	- - S S	- - - -	- - - -	-
Allston at 9th	4 4 4 4	None	- - X -	Dbl Dbl D D	Y Y - Y	- - Stop Stop	Relocate westerly STOP sign closer to curb or in choker to increase visibility. Paint solid centerline on Allston.
Allston at Jefferson	- - 3 3	None	- - X -	- - D D	- Y - Y	- - Stop Stop	Paint solid centerline on Allston.
Allston at Roosevelt	4 4 4 4	None	- - X X	- - S S	- - - -	- - Stop Stop	Prune plum tree on north leg. Relocate bottle brush bush on south leg so it does not obscure STOP sign. Paint STOP bars on Roosevelt.
Amador at Mariposa	1 - - -	-	- - - -	- - - -	- - - -	- - - -	Paint STOP Bar and centerline to add emphasis to STOP sign location.
Arch at Vine	2 2 - -	-	X X - -	- - - -	- - - -	- - - -	Prune trees on north leg. Consider choker to increase STOP sign visibility. Paint STOP marking over blackened YIELD markings.
Bancroft at McGee	4 4 4 4	None	- - X X	- - S S	- - - -	- - Stop Stop	Prune trees on south leg. Paint STOP bars on McGee.

Notes: (a) 1-way, 2-way, 3-way, 4-way 5-way STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow (c) Location and color of crosswalk -- W - white; Y - yellow;

Table 22
STOP SIGN EVALUATION (Page 2)

Location	Stop Signs (a) N S E W	All-way Signs	Stop Bar N S E W	Centerline (b) N S E W	Cross-walk (c) N S E W	Pavement Markings N S E W	Comments
Bancroft at McKinley	4 4 4 4	None	- - - -	- - S S	Y Y Y -	- - Stop Stop	Remove SLOW SCHOOL XING markings on Bancroft approaches.
Benvenue at Russell	4 4 4 4	None	X X - -	S S - -	- - W W	Stop Stop - -	Paint STOP over blackened YIELD markings on Benvenue. Prune trees on north and south legs.
Berryman at Milvia	4 4 4 4	None	X X - -	- - - -	- - - -	- - - -	Paint STOP bars on Berryman. Prune trees on north leg
Berryman at Shattuck	3 3 - 3	None	X - - -	Dbl Dbl - -	- W - W	- - - -	Remove SLOW SCHOOL XING markings on north and south legs
Blake at California	- - 2 2	-	- - - -	- - S S	- - - -	- - - -	Paint STOP bar and centerline on Blake
Blake at Dana	- - 2 2	-	- - X X	- - S S	- - - -	- - - -	Prune branches on east leg
Blake at Grant	- - 2 2	-	- - X X	- - - -	- - - -	- - - -	Centerline and STOP markings would be useful since street is offset.
Blake at Mabel	- - 2 2	-	- - X X	- - S S	- - - -	- - - -	Minor pruning on east and west legs
Boise at 66th	- 1 - -	-	- - - -	- - - -	- - - -	- - - -	
Bonita at Vine	2 2 - -	-	X X - -	- - - -	- - - -	- - - -	Paint STOP over blackened YIELD markings.
Buena Vista at LeRoy	4 4 4 4	None	- X X X	S - D S	Y - - -	- - - -	Prune trees on north leg.
California at 63rd	- - 2 2	-	- - - -	S S - -	- - - -	- - - -	-
California at Carleton	- - 2 2	-	- - - -	S S - -	- - W W	- - - -	-
California at Channing	- - 2 2	-	- - X X	S S - -	- - - -	- - - -	-
California at Derby	4 4 4 4	None	- - - -	S S - -	- Y Y Y	- - - -	Relocate tree obscuring STOP sign on east leg.
California at Julia	- - 2 2	-	- - - -	S S - -	- - - -	- - - -	STOP bars would be useful on Julia
California at Lincoln	- - 2 2	-	- - X X	S S - -	- - - -	- - - -	Prune trees on east leg immediately. Paint STOP marking over blackened YIELD.
California at Parker	4 4 4 4	None	- - - -	S S - -	W W W W	- - - -	Relocate STOP sign on east leg from behind tree.
California at Prince	- - 2 2	-	- - - -	S S S S	W - W -	- - - -	Remove 15 MPH markings from all legs. Paint STOP BAR on west leg.
California at Rose	4 4 4 4	None	- - X X	S S S S	- - - -	- - Stop Stop	Prune trees on east leg. Paint STOP bars on Calif.
California at Russell	- - 2 2	-	- - - -	S S - -	- - W W	- - - -	Prune tree on west leg.

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 22
STOP SIGN EVALUATION (Page 3)

Location	Stop Signs (a) N S E W	All-way Signs	Stop Bar N S E W	Centerline (b) N	S	E	W	Crosswalk (c) N S E W	Pavement Markings N	S	E	W	Comments
California at Stuart	- - 2 2	-	- - - -	S	S	-	-	- - - -	-	-	-	-	-
California at Tyler	- - 2 2	-	- - - -	S	S	-	-	- - - -	-	-	-	-	-
California at Ward	4 4 4 4	None	- - - -	S	S	-	-	Y Y Y Y	-	-	-	-	-
California at Woolsey	4 4 4 4	Yes	X X X X	S	S	-	-	- - - -	-	-	-	-	Paint STOP markings over YIELD markings on Calif. since YIELD still visible.
Camelia at 4th	- - 2 2	-	- - X X	-	-	S	S	- - - -	-	-	-	-	-
Camelia at 5th	2 2 - -	-	X X - -	-	-	-	-	- - - -	-	-	-	-	-
Camelia at 7th	- - 2 2	-	- - - -	-	-	-	-	- - - -	-	-	-	-	-
Camelia at 8th	2 2 - -	-	- - - -	-	-	-	-	- W W -	-	-	-	-	-
Camelia at 9th	- - 2 2	-	X X X X	S	S	S	S	- - - -	-	-	-	-	Remove STOP bars on 9th unless a 4-way STOP is contemplated.
Camelia at 10th	2 2 - -	-	- - - -	-	-	-	-	- - - -	-	-	-	-	-
Camelia at Cornell	2 2 - -	-	- - - -	S	S	S	S	- - - -	-	-	-	-	Relocate small trees on north leg. Consider painting STOP bars on Cornell.
Camelia at Kains	2 2 - -	-	- - - -	-	-	-	-	- - - -	-	-	-	-	-
Camelia at Stannage	- - 2 2	-	- - - -	-	-	-	-	- - - -	-	-	-	-	Prune tree on west leg. Be sure that blackened 15 MPH markings do not reappear.
Capistrano at The Alameda	4 4 4 4	Yes	X - X -	Dbl	Dbl	-	-	- W - W	-	-	-	-	-
Carleton at Dana	- - 2 2	-	- - X X	S	S	S	S	- - - -	-	-	-	-	Remove 15 MPH markings on Carleton. Prune tree on east leg. Be sure that YIELD markings on Dana do not reappear.
Carleton at Grant	- - 2 2	-	- - - -	-	-	-	-	- - - -	-	-	-	-	-
Carleton at Mabel	- - 2 2	-	- - X X	-	-	-	-	- - - -	-	-	-	-	Prune tree on east approach.
Cedar at Acton	4 4 4 4	None	X X - X	-	-	D	D	- - W -	-	-	-	-	Paint solid centerline on Cedar.
Cedar at LaLoma (Yield)	Y Y - -	-	X X - -	Dbl	Dbl	-	Dbl	- - - W	-	-	-	-	Paint YIELD markings over blackened STOP markings on LaLoma. Prune trees on south leg.
Cedar at McGee	4 4 4 4	None	- - X X	-	-	D	D	- - - -	-	-	-	-	Paint STOP bars on McGee and solid centerline on Cedar

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 22
STOP SIGN EVALUATION (Page 4)

Location	Stop Signs(a) N S E W	All-way Signs	Stop Bar N S E W	Centerline(b) N S E W	Cross-walk(c) N S E W	Pavement Markings N S E W	Comments
Chestnut at Delaware	4 4 4 4	None	X X X X	- - S S	- - - -	- - Stop Stop	Continue pruning trees on west leg
Colusa at Hopkins	3 - 3 3	None	- - - X	- - D D	- - Y -	- - Stop Stop	Construct choker on east leg and placeSTOP sign in it to assume visibility paint STOP bar on Colusa and solid centerline on Hopkins.
Colusa at Monterey	4 4 4 4	None	- - - -	S - Dbl Dbl	W W W W	Stop - Stop Stop	Paint double yellow centerline on east leg. Paint centerline and STOP marking on south leg.
Colusa at Sonoma	4 4 4 4	None	- X X X	- S S S	- - - -	- - - -	Relocate STOP sign on east leg east of tree to improve visibility. Stripe centerline and STOP Bar on North leg.
Colusa at Thousand Oaks	4 4 4 4	None	X - - -	S S - -	- W W W	Stop Stop Stop Stop	Stripe centerline on east/west legs.
Cornell/Santa Fe	3 3 - 3	-	X X - X	S S - -	- - - -	- - - -	Not an all-way STOP intersection.
Cragmont at Santa Barbara	- - - 1	-	- - - -	- - - -	- - - -	- - - -	STOP bar may be useful.
Curtis at Hearst	- - 2 2	-	- - X X	S S - -	- - - -	- - - -	Remove 15(MPH) markings. Paint centerline on Curtis. Add red curb on all approaches. Relocate no parking sign obscuring westerly STOP sign.
Dana at Derby	2 2 - -	-	X X - -	S S - -	- - - -	- - - -	Prune tree on north leg.
Deakin at Prince	2 2 - -	-	X X - -	- - - -	- - - -	- - - -	Paint STOP marking over reappearing YIELD markings on Deakin.
Deakin at Woolsey	2 2 - -	-	- X - -	- - - -	W - - -	- - - -	Continuing pruning on south leg.
Derby at Milvia	4 4 4 4	None	- - - -	D D - -	W W W W	- - - -	Paint solid centerline on Milvia.
Derby at Fulton	4 4 4 4	None	- - - -	D D S S	W W W W	- - Stop Stop	Paint solid centerline and STOP markings on Fulton.
Derby at Grant	2 2 - -	-	- X - -	- - - -	- - - -	- - - -	Relocate tree on north leg which obscures STOP sign. Paint STOP bars on Grant since curb lines are irregular.
Domingo at El Camino	- 1 - -	-	- - - -	- S - -	- Y Y Y	- - - -	STOP sign vandalized.
Domingo at Hazel	1 - - -	-	- - - -	- - - -	Y - - -	- - - -	Centerline may be helpful on north leg.
Domingo at Oakvale	- 1 - -	-	- - - -	- - - -	- - - -	- - - -	STOP sign obscured by trees. If retained construct choker and move sign to be more vis ble.
Domingo at Plaza Drive	3 3 3 -	None	- X - -	Dbl Dbl Dbl -	W - W -	- - Stop -	Consider formalizing choker on east leg and move STOP sign out for better visibility.

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 22
STOP SIGN EVALUATION (Page 5)

Location	Stop Signs (a) N S E W	All-way Signs	Stop Bar N S E W	Centerline (b) N S E W	Cross-walk (c) N S E W	Pavement Markings N S E W	Comments
Delaware at 7th	- - 2 2	-	- - - -	- - - -	W - W -	- - - -	Paint STOP bar on west leg.
Delaware at 8th	2 2 - -	-	- - - -	- - - -	W - W -	- - - -	Paint STOP bar on south leg.
Delaware at 10th	2 2 - -	-	- X - -	- - S S	W - - -	- - - -	Relocate STOP sign on north leg north of tree.
Edith at Vine	2 2 - -	-	X X X X	S S S S	- - - -	- - - -	Prune trees on Edith. Remove limit lines on Vine if 2-way STOP is retained.
El Dorado at Lassen	3 - 3 3	-	X - X X	- - S -	- - - -	- - - -	Relocate STOP sign on north leg northward to be more visible. Prune trees on north and west legs. Consider centerline on north and west legs to add emphasis to STOP.
Ellis at Harmon	2 2 - -	-	X X - -	- - - -	- - - -	- - - -	Centerline would be helpful on Harmon.
Ellis at Prince	2 2 - -	-	- X - -	- - - -	Y - - -	- - - -	Remove slow school xing markings on north and south approaches.
Ellis at Woolsey	2 2 - -	-	X X - -	- - - -	- - - W	- - - -	Paint STOP over reappearing YIELD markings on Ellis.
Ellsworth at Parker	4 4 4 4	None	- - - -	Dbl Dbl S S	W W W W	- - Stop Stop	WAR painted on westerly STOP sign
Ellsworth at Russell	4 4 4 4	None	- X - -	D D S S	Y - Y Y	- - - -	Paint solid centerline on Ellsworth.
Ellsworth at Stuart	4 4 4 4	None	X X X X	D D S S	- - - -	- - - -	Prune tree on west leg. Paint solid centerline on Ellsworth.
Ensenada at Tacoma	4 4 4 4	None	X - - X	- - - -	- Y Y -	- - - -	-
Euclid at Eunice	3 3 - 3	None	X - - -	D D - S	- W - W	Stop Stop - -	Paint solid yellow centerline on Euclid.
Euclid at Grizzly Peak	- - - 1	-	- - - -	D D	- - - W	- - - -	Prune trees on west leg.
Euclid at Marin	4 4 4 4	None	- X - -	D D - S	W - W -	- - - -	Paint STOP marking on east and west legs. Paint solid yellow center on east leg and on Euclid.
Eunice at Shattuck	4 4 4 4	None	X X X X	Dbl Dbl - -	- - - -	Stop Stop Stop Stop	-
Eunice at Walnut	2 2 - -	-	- - - -	- - - -	W - W -	- - - -	Prune trees on north leg. Paint STOP bar on south leg.
Eunice at Spruce	4 4 4 4	None	- X - -	Dbl Dbl -	W - W W	Stop Stop Stop Stop	Raise reflective pavement marking on Spruce centerline.
Francisco at Grant	4 4 4 4	None	X X X X	S S S S	- - - -	- - - -	Prune tree on east leg.
Francisco at McGee	4 4 4 4	None	X X X X	S S S S	- - - -	- - - -	Raise STOP sign on north leg which is low.

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 22
STOP SIGN EVALUATION (Page 6)

Location	Stop Signs(a) N S E W	All-way Signs	Stop Bar N S E W	Centerline(b) N	S	E	W	Cross-walk(c) N S E W	Pavement Markings N	S	E	W	Comments
Forest at Piedmont	4 4 4 4	None	X - - -	Dbl	Dbl	Dbl	Dbl	- Y Y -	-	-	-	-	Prune trees on south leg. Remove tree limb on east leg.
Fresno at Sonoma	1 - - -	-	X - - -	S	-	-	-	- - - -	-	-	-	-	Consider moving STOP sign northward to improve visibility.
Fulton at Oregon	4 4 4 4	None	X - - -	Dbl	Dbl	S	S	- Y Y Y	-	-	-	-	-
Fulton at Prince	1 - - -	-	- - - -	-	-	-	-	W - - W	-	-	-	-	STOP sign post bend slightly.
Gilman at Hopkins	3 3 - 3	None	X X - -	S	S	-	S	- - - W	Stop	Stop	-	Stop	School flashers especially southbound may be confusing to drivers approaching STOP. Prune tree on north leg.
Gilman at Santa Fe	4 4 4 4	None	- - X -	Dbl	-	Dbl	Dbl	W W - W	Stop	-	Stop	Stop	Paint centerline and STOP marking on south leg. Consider constructing choker on west leg or STOP sign can be moved to a more visible position.
Grant at Oregon	4 4 4 4	None	X X X X	S	S	S	S	- - - -	-	-	-	-	Remove 15(MPH) markings on all legs.
Grant at Parker	2 2 - -	-	X X - -	S	S			- - - -	-	-	-	-	Prune trees on south leg.
Grant at Rose	4 4 4 4	None	- - - -	-	-	S	S	Y Y Y Y	-	-	Stop	Stop	-
Grant at Stuart	2 2 - -	-	X X - -	-	-	-	-	- - - -	-	-	-	-	Prune or relocate Immediately tree obscuring STOP sign on north leg. Prune trees on south leg.
Grant at Vine	4 4 4 4	None	X X X X	S	S	S	S	- - - -	-	-	-	-	Prune trees on north and south legs.
Grizzly Peak at Marin	4 4 4 4	None	- X X X	D	D	-	S	W - - -	Stop	Stop	-	-	Prune hedge on east leg. Relocate STOP AHEAD sign of south leg further south. Install STOP AHEAD sign on north leg stripe solid centerline on Grizzly Peak.
Grizzly Peak at Muir Way	4 4 4 4	None	X X - X	D	D	-	-	- - - -	Stop	Stop	-	-	Offset intersection with Stevenson with crosswalk between Muir and Stevenson.
Grizzly Peak at Shasta	3 3 - 3	None	X X - X	Dbl	Dbl	-	S	- - - -	Stop	Stop	-	Stop	Relocate small trees on north leg which obscure STOP sign.
Grizzly Peak at Spruce	4 4 4 4	None	- - X X	S	S	S	Dbl	- - - -	-	-	-	-	Improve delineation of island and lanes on north leg. Short STOP signs in island on north leg.
Hawthorne Terr. at Vine	3 3 - 3	None	X X - X	S	S	-	S	- - - -	-	-	-	-	Prune trees on north leg.
Hearst at 7th	2 2 - -	-	X X - -	S	S	-	-	- - - -	-	-	-	-	North STOP sign partially obscurred by pole.
Hearst at 8th	- - 2 2	-	- - X X	S	S	-	-	- - - -	-	-	Stop	Stop	-

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 22
STOP SIGN EVALUATION (Page 7)

Location	Stop Signs (a) N S E W	All-way Signs	Stop Bar N S E W	Centerline (b) N	S	E	W	Crosswalk (c) N S E W	Pavement Markings N	S	E	W	Comments
Hearst at 10th	- - 2 2	-	- - X X	S	S	-	-	- - - -	-	-	-	-	Prune trees on east leg.
Henry at Vine	2 2 - -	-	X X - -	S	S	-	-	- - - -	-	-	-	-	Paint STOP over reappearing YIELD markings on Henry. Prune tree on south leg.
Hillcrest at Eucalyptus (South)	- - 1 -	-	- - - -	-	-	-	-	- - - -	-	-	-	-	-
Hillcrest at Eucalyptus (North)	- 1 - -	-	- - - -	-	-	-	-	- - - -	-	-	-	-	STOP sign obscured, Consider constructing choker and more sign to more visible position.
Hillcrest/Roanoke/Uplands	5 5/5 5 5	None	X X X X	S	S	-	-	- - - -	-	-	-	-	Paint STOP bar on Roanoke. Paint STOP over reappearing YIELD markings on both legs of Hillcrest.
Hilgard at Scenic	2 2 - -	-	X X - -	-	S	S	-	- - - -	-	-	-	-	Prune tree on south leg. Paint STOP over blackened YIELD markings if they begin to reappear.
Idaho at 66th	- - 2 2	-	- - X X	-	-	S	S	- - - -	-	-	-	-	Paint centerline on Idaho.
Josephine at Vine	2 2 - -	-	- X - X	-	-	-	X	- - - -	-	-	-	-	Paint center and STOP bar on north leg. Paint centerline on east leg. Repaint STOP bar on south leg. Remove 15 (MPH) markings on south and west legs.
Kains at Page	2 2 - -	-	- - - -	-	-	-	-	- - - -	-	-	-	-	-
King at Prince	- - 2 2	-	- - - -	-	-	-	-	Y Y Y Y	-	-	-	-	Remove SLOW SCHOOL XING markings on west leg. Prune tree on west leg.
LaLoma at Ridge	4 4 4 4	None	- - X X	S	S	S	S	W W - -	-	-	-	-	Prune trees on north and south legs. Paint STOP over blackened YIELD markings if they begin to reappear.
LeConte at LeRoy	4 4 4 4	None	- - - -	-	-	-	-	W W W W	-	-	-	-	Prune tree on west leg. Paint STOP over YIELD markings on LeRoy.
LeConte at Ridge/Scenic	5 5/5 5 5	None	- - - -	S	S	-	S	W W W W	-	-	-	-	Improve striping for NB Scenic to lessen confusion at Ridge. Prune tree on north leg. Paint STOP over reappearing YIELD marking on north leg.
LeRoy at Ridge	4 4 4 4	None	- - - -	S	S	-	-	W W W W	-	-	-	-	Paint STOP over blackened YIELD markings if they begin to reappear.
LeRoy at Virginia	4 4 4 4	None	X X X X	-	-	-	-	- - - -	-	-	-	-	-
Los Angeles at Oxford	4 4 4 4	None	- - X -	S	S	-	-	- Y - Y	-	-	-	-	Paint STOP on north leg.
Los Angeles at Spruce	3 3 - 3	None	- X - -	Dbl	Dbl	-	S	W - - W	Stop	Stop	-	-	Prune tree on south leg obscuring STOP AHEAD sign. Replace 24" STOP signs on Spruce with at least 30" signs.

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 22
STOP SIGN EVALUATION (Page 8)

Location	Stop Signs (a) N S E W	All-way Signs	Stop Bar N S E W	Centerline (b) N	S	E	W	Crosswalk (c) N S E W	Pavement Markings N	S	E	W	Comments
Mabel at 66th	1 - - -	-	- - - -	-	-	-	-	- - - -	-	-	-	-	Partially obscured by power pole.
McGee at Parker	- - 2 2	-	- - - -	-	-	-	-	- - - -	-	-	-	-	Prune tree on west leg. Relocate STOP sign on east leg or remove tree.
McGee at Stuart	- - 2 2	-	- - - -	-	-	-	-	- - - -	-	-	-	-	Paint STOP bars on Stuart.
Milvia at Parker	4 4 4 4	None	X X X X	Dbl	Dbl	Dbl	Dbl	- - - -	-	-	-	-	Prune tree on west leg.
Milvia at Stuart	4 4 4 4	None	X X - -	S	S	-	-	- - - -	-	-	-	-	Paint STOP bars on Stuart.
Milvia at Virginia	4 4 4 4	None	- X - -	S	S	-	-	Y - Y Y	-	-	-	-	Prune tree on south leg. Advance flashers on Milvia.
Monterey at Posen	4 4 4 4	None	X X - -	S	S	-	-	- - W W	-	-	-	-	-
Montrose at Santa Barbara	4 4 4 4	None	X X X X	D	D	D	S	- - - -	-	-	-	-	Replace vandalized STOP sign on the west leg. Paint solid centerline on north, south and east legs.
Page at Stannage	2 2 - -	-	- - - -	-	-	-	-	- - - -	-	-	-	-	Prune tree on north leg. Blackened 15(MPH) markings on all legs.
Peralta at San Lorenzo	4 4 4 4	None	- X X -	S	S	S	S	W - - W	-	-	-	-	Prune tree on south leg.
Piedmont at Webster	1 - - -	-	- - - -	S	-	-	-	W - - -	-	-	-	-	Prune trees on north leg.
Prince at Wheeler	- - 2 2	-	X X X X	S	S	S	S	- - - -	-	-	Stop	Stop	Remove 15(MPH) markings on all legs. Remove limit lines on Wheeler.
San Fernando at Thousand Oaks	4 4 4 4	None	X X X X	-	-	-	-	- - - -	-	-	-	-	Prune trees on north, south and east legs.
Scenic at Vine	- - 2 2	-	- - - -	-	-	-	-	- - - -	-	-	-	-	-
Thousant Oaks at Vincente	4 4 4 4	None	X X X X	-	-	-	-	- - - -	-	-	-	-	Prune branches on west leg.
The Alameda at Thousand Oaks	4 4 4 4	None	X X X X	-	S	S	S	- - - -	-	-	-	-	Blackened YIELD markings on The Alameda.
Vine and Walnut	4 4 4 4	None	- - X -	-	-	-	-	W W - W	-	-	-	-	Construction has obliterated part of the northerly crosswalk.
Virginia at 7th	2 2 - -	-	- - - -	-	-	-	-	- W W -	-	-	-	-	Paint STOP bar on north leg. Remove 15(MPH) markings previously blackened on all legs.
Virginia at 8th	- - 2 2	-	- - - -	Dbl	-	-	-	W W W W	-	-	-	-	Remove 15(MPH) markings previously blackened on all legs.

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 22
STOP SIGN EVALUATION (Page 9)

Location	Stop Signs (a) N S E W	All-way Signs	Stop Bar N S E W	Centerline (b) N S E W	Cross-walk (c) N S E W	Pavement Markings N S E W	Comments
Virginia at 9th	2 2 - -	-	X X X X	S S S S	- - - -	- - - -	Remove limit lines on Virginia. Remove 15(MPH) markings previously blackened.
Virginia at 10th	- - 2 2	-	- - X X	- - - -	W W - -	- - - -	Remove 15(MPH) markings on 10th.

Notes: (a) 1-way, 2-way, 3-way, 4-way, 5-way, STOP by location of sign. (b) Location and type of striping -- D - dashed yellow; S - solid yellow; Dbl. - double yellow. (c) Location and color of crosswalk -- W - white; Y - yellow.

Table 23
TRAFFIC MANAGEMENT PLAN (February 1976) -- REVISIONS TO MAP

Location	Designated Device	Comments
Allston at Grant	Traffic Circle	Removed
Ashby at King	Traffic Signal	Not Installed
Benvenue at Russell	Traffic Circle	All-way STOP
Cedar at Curtis	STOP Signs	Removed
Cedar at LaLoma	STOP Signs	Changed to YIELD
Channing at Shattuck	Turn Restrictions	Not Installed
Claremont at The Uplands	Traffic Signal	Not Installed
College at Derby	Traffic Signal	Not Installed
Colusa at Solano	Traffic Signal	Not Installed
Curtis at Delaware	Traffic Circle	Removed
Delaware at Franklin	Traffic Circle	Removed
Derby at Grove	Traffic Signal	Not Installed
Eunice at Sutter	Traffic Signal	Not Installed
Kittredge at Oxford	Traffic Signal	Not Installed
Michigan at Spruce	STOP Sign	Removed
Northampton at Spruce	STOP Sign	Removed
Ridge East of Scenic	Closure	STOP Sign
Rose at Sacramento	Traffic Signal	Not Installed
Tunnel at The Uplands	Traffic Signal	Not Installed

NEIGHBORHOOD ENVIRONMENT

In preparing for the evaluation of the Traffic Management Plan, the desirability of assessing changes in the quality of life in neighborhood areas was recognized by the City staff. Some of the factors we considered, such as safety, air pollution and noise, are discussed elsewhere in this report. This section was envisioned as a discussion of the cumulative effect of these factors as perceived by people living in Berkeley. It was also intended to analyze changes in neighborhood cohesiveness resulting from changes in traffic.

Unfortunately, due to lack of time and resources, no attitudinal studies were conducted for this section. At one point it appeared that the U.S. Urban Mass Transportation Administration (UMTA) would conduct personal interviews in three neighborhoods in conjunction with the City's evaluation study. However, UMTA decided not to pursue such a study at this time because of the political controversy surrounding the Traffic Management Plan, particularly with the impending traffic initiative.

Therefore, in order to offer some perspective on the subject of neighborhood environment, particularly the way in which people perceive their surroundings, staff of the City Department of Transportation have summarized some conclusions drawn from a study recently prepared by Professor Donald Appleyard, of the University of California. This report is entitled "Traffic in Neighborhoods: Policies for More Livable Streets." Professor Appleyard's publication focuses on two studies analyzing the effect of traffic on San Francisco streets. It also summarizes traffic management plans in Oakland, London, and several other cities in Europe, Australia and Asia. The conclusions which follow are most evident in his San Francisco studies.

While the conclusions Professor Appleyard has drawn from his data are as yet preliminary, significant consistencies have surfaced. Most significantly, Appleyard's surveys found that traffic is the concern of the majority of those living in urban neighborhoods. Indeed, the interplay between traffic volume, speed, and composition was found to outrank crime problems and to permeate the social fabric of urban life. This finding is supported by the recent U.S. Census housing survey which also showed that traffic is a more widespread neighborhood concern than crime even in low income neighborhoods.

Those aspects of urban life identified by Appleyard as easily degradable by auto traffic are familiar and easily appreciated by urban dwellers:

1. Danger to children: Child street safety was the most widespread concern, especially of parents. Even on lightly traveled streets, residents were concerned about accidents from speeding drivers.

2. Danger to the elderly: The elderly -- a segment of the urban population often valued by urban dwellers for their contribution to neighborhood stability and sociological richness -- are also negatively affected by

Neighborhood traffic. Especially aggravated is the problem of elderly pedestrians forced to mix with auto traffic while crossing streets; the slower walk speeds of the elderly increase greatly the danger of being struck by an auto.

3. Disturbing the public peace: Traffic-generated noise and vibration in residential districts were found by Appleyard and other researchers to be significantly correlated with resident dissatisfaction with their neighborhood. Nosie from improperly muffled motorcycles, trucks and buses were repeatedly found to disturb sleeping, talking, relazing and even eating.

4. Decline in friendship and acquaintance pattern: Essential to the viability of any neighborhood is a feeling by its inhabitants of a sense of place or neighborhood cohesiveness. A sense of place, in turn, is dependent upon a feeling of responsibility for neighborhood well-being, of terriroty and of friendship. Professor Appleyard's research indicates, however, that in the face of excessive motor traffic, a sense of place or neighborhood cohesiveness is most difficult to achieve. When asked to reproduce from memory a sketch of that part of the neighborhood for which was felt a sense of territory and responsibility, persons living on busy San Francisco streets were able to draw sketches of considerably less detail and scope than those living on lightly traveled streets. Thus, on heavily trafficked streets, the "neighborhood" with which one identified might extend a mere three buildings on either side of one's dwelling; the "neighborhood" might extend to a whole block on <u>both</u> sides of the street for one living on a lightly traveled street. Also, on lightly traveled streets, residents tended to know an average of four times as many neighbors as on heavily traveled streets.

5. Decline in privacy: A feeling of privacy is also essential if a neighborhood is to be viable -- both a privacy while outside of one's dwelling, and a privacy inside. A feeling of neighborhood or "outside" privacy is possible on a lightly traveled street; those able to observe street or yard activity are at least from the neighborhood. On a heavily traveled street, however, outsiders in large numbers are able to observe neighborhood activities; thus, there is no privacy for yard activity or neighborhood walking. Professor Appleyard found also that privacy <u>within</u> one's own home is intruded upon by the noise, vibration and exhaust odors of passing traffic.

This brief summary of the research done by those seeking to understand the relationship between traffic and the livability of urban neighborhoods has an important bearing on the more elusive and unquantifiable impacts of the Traffic Management Plan on Berkeley's residential discticts. For, in attempting to evaluate the Plan, it is comparatively easy to collect traffic flow data and evaluate diverter installations on the basis of traffic count differentials; it is more difficult to isolate and quantify the elusive

sociological effects a decrease in traffic can cause. This difficulty is compounded by the brief period during which Berkeley's diverter system has been in operation.

Nevertheless, extensions of Appleyard's findings to Berkeley's experience with traffic diversion can be made with a fair degree of certainty. Thus, over time, it is predictable that those Berkeley streets which are protected from levels of traffic beyond the neighborhood's environmental capacity would (a) have greater safety for children; (b) find a substantial decline in the number of citizens leaving the neighborhood because of the pervasive intrusion of traffic noise and vibration into their homes and lives; (c) experience an increasing sense of neighborhood ownership, pride and sense of place; and (d) experience greater neighborhood cohesiveness, a sense of privacy, and greater stability.

For those Berkeley neighborhoods which are experiencing out-migration of families, increasing isolation and alienation of the elderly, and general deterioration in livibility, Professor Appleyard's report tends to indicate that auto traffic is one of the responsible factors. Thus, the ability of the Traffic Management Plan to reverse these conditions on certain streets must be included as a benefit of the plan in its overall evaluation.

Noise Impacts

One indicator of neighborhood effects of the Traffic Management Plan is noise levels. Pre-Traffic Management Plan noise measurements were not taken, so "before" and "after" noise level comparisons are not possible. However, sound data has been gathered after Plan implementation indicating noise levels on typical local and arterial streets. This is displayed on Table 24.

The noise measurements depicted below were taken on weekdays in late April, 1976, using the A_S scale. The A_S scale on a sound level meter is designated for general community noise. It is the scale that is electronically designed to approximate all noise present, as heard by the human ear. This scale A_S is normally designated as the standard unit of decibels in community noise ordinances.

These sound measurements indicate average noise levels in a range considered normally acceptable in residence areas. Average noise levels on the major streets listed in the table are on the threshhold of a range considered normally unacceptable as a residential environment. However, considering the traffic levels which existed on these streets prior to Traffic Management implementation, there is likely no meaningful change in noise levels on these streets from that experienced previously. For further discussion of traffic-related noise levels in Berkeley, consult Environmental Impact Report, Technical Supplement, Neighborhood Traffic Study, City of Berkeley, Department of Public Works, October, 1974.

Table 24
SOUND LEVEL STUDY - TRAFFIC IMPACT

Location	Time	24-Hour Traffic Vol.	Decibel Level A_S Scale Ambient	Average
MAJOR STREET				
1. Derby E. of Warring	9:30a-10:00a	19,400	60	74
2. Derby E. of Warring	4:20p- 4:50p	19,400	65	74
3. College S. of Derby	10:15a-10:45a	15,000	55-60	73
4. University, E. of 9th	12:30p- 1:00p	37,000*	65	76
5. Ashby, W. of Benvenue	3:05p- 3:35p	22,000	60-65	73
LOCAL STREET				
1. Russell, E. of Piedmont	10:55a-11:55a	1,000*	50-55	64
2. Regent, N. of Prince	2:00p- 3:00p	400	52	64
3. Fulton, S. of Stuart	8:30a- 9:30a	1,000	50	65
4. Derby, W. of Acton	10:55a-11:55a	1,500*	50	67
5. Derby, E. of California	9:45a-10:45a	2,000*	45	67

MAJOR AND COLLECTOR STREET SUMMARY

Street	24-Hr. Volume	Ambient	Average Decibel	Difference
Major Street Average	22,600	62	74	12
Local Street Average	1,200	50	65	15

(* Estimated Volume)

CITIZEN COMMENT

Since initiation of the Traffic Management Plan, the City has received many letters both in opposition and in support of the program. As of April 8, 1976, a total of 732 letters from Berkeley residents have been received by the Planning Department. This section is intended to categorize those responses to provide a general perspective of the issues which have been raised in the correspondence. The letters are divided into two categories: a) 304 general letters which did not relate to the specific neighborhoods of the writers; and b) 428 letters which did relate to specific neighborhoods.

General Letters Critical of the Traffic Management Plan

Of the letters with general comments about the Traffic Management Plan, 245 of these expressed criticism of the program. These concerns are categorized as follows:

- Many of the letters stated opposition to the entire Traffic Management Plan. They indicated frustration and anger because of the inconvenience posed by the Plan. The diverters were often mentioned as being a waste of the taxpayer's money. It appeared to be of primary importance to these letter writers to be able to drive freely and fast wherever they wished to go.

- Concerns were raised about access to Alta Bates Hospital and emergency access by police, fire and ambulance vehicles.

- Increased air pollution and increased gasoline consumption were mentioned as reasons for opposition to the Plan.

- The diverters were criticized for their appearance; they were categorized in several cases as being ugly.

- Some of the other letters in general opposition to the Traffic Management Plan were ones which requested specific changes or which said that the Plan would be satisfactory if a better public transportation system existed in Berkeley.

- A few letters said that the Plan would adversely affect business. Some of these letters were from business people, while others were from individuals who said they would not shop in Berkeley.

- Other letters detailed a variety of concerns including resentment of the government impinging on their freedom of movement and an indication that neighborhood pressure groups had been responsible for pushing this plan through.

General Letters in Support of the Traffic Management Plan

Of the 59 letters favorable to the Traffic Management Plan, the responses could be grouped into the following categories:

- Many writers expressed support for the concept of discouraging automobile usage and praised the plan for its efforts in that regard.

- Many letters indicated that the quality of life in many Berkeley neighborhoods has improved as a result of the plan. The neighborhoods are quieter and people are more friendly.

- The enhancement of safety for children, pedestrians, bicyclists and pets was cited by many of the letters as a desirable consequence of the Traffic Management Plan.

Summary of Letters Reflecting Specific Neighborhood Concerns

A total of 428 letters were received which mentioned specific neighborhoods and the effect of the Traffic Management Plan on these areas. The City's Planning Department analyzed these responses and categorized them as follows:

- Emerson: There were 13 letters favoring the plan and 37 letters in opposition to the plan. In addition, there were four petitions with a total of 173 signatures supporting the Traffic Management Plan. A wide range of opinions were expressed in these letters, with diverse reactions on various specific devices. There was specific opposition to the traffic increase on Derby/Warring/Belrose.

- Triangle: Three letters were in support of the plan and 15 letters were critical of the plan. Most of the opposition mentioned the inconvenience of the semi-diverter at Lewiston/Alcatraz.

- Uplands: Nine letters were received favoring the plan and 27 letters were in opposition. A petition with 174 signatures was received which opposed all diverters. The letters critical of the plan indicated a general feeling that arbitrary decisions had been made in the placement of the specific diverters.

- 1000 Oaks: Thirteen letters were received in support of the plan and 12 letters were submitted in opposition to the plan. In addition, there was a petition* with 1700 names which opposed the semi-diverter on Fresno at Solano/Marin.

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*This petition included signatures of many non-Berkeley residents. The other petitions included in this section may also include some non-residents.

- Bateman/Willard: There were 18 letters favoring the plan and 19 letters in opposition to the plan. There was also a petition with 50 signatures in opposition. The major objection to the plan centered around obstructions to access to Alta Bates Hospital. The residents in favor of the plan wanted hospital traffic off of neighborhood streets.

- LeConte/South Campus: Twelve letters were received in support of the plan, and 14 letters were in opposition. Residents favoring the plan were pleased with the improvement of the neighborhood including its quiet and safety. Opposing residents resented the inconvenience. A petition with 41 signatures, mostly from residents on Oregon Street, indicated disfavor with the increased traffic in front of their homes.

- North Campus: Five letters were received in favor of the plan and one letter is opposition. Some of the letters which favored the Traffic Management Plan requested specific changes to improve it.

- NOBBS/Westbrae: From this area, 54 letters were received in favor of the plan. In addition, there were four petitions with a total of 149 signatures in support of the Traffic Management Plan. There were also 27 letters and two petitions with a total of 32 signatures in opposition to the program. This group of responses is almost exclusively directed towards specific devices, mainly stop signs. Most indicate a general feeling for the need for some type of traffic management. A majority of the writers favor STOP signs, especially on Cedar Street, for safety reasons, because it is a residential street.

- North Hills: 65 letters were received in support of the Traffic Management Plan and 64 were submitted in opposition to the plan. In addition, there was a petition with 148 names which supported the Traffic Management Plan. The biggest controversy in this area was over the diverter at Spruce and Rose. There was a general feeling that traffic needs to be controlled, but there was disagreement on the specific method of accomplishing that end.

- South of University and West of Shattuck: Nine letters were received in support of the plan and 11 letters were received in opposition to the plan. In addition, there were petitions with 29 total signatures in support, and a petition with 37 signatures in opposition. Merchants on Adeline/Ashby indicated that the plan was bad for business, and specifically opposed the diverter at Russell and Milvia in their petition. The letters favorable toward the plan indicated support for specific devices for safety reasons.

In many cases in the neighborhood letters, there was no way to determine if a letter opposing a particular STOP sign or diverter really indicated opposition to the entire Traffic Management Plan. Yet these types of letters were counted against the plan. If the communications exclusively opposing a single traffic control device were removed from the count, neighborhood resident response would be overwhelmingly in favor of the Traffic Management Plan.

Context of the Traffic Management Plan

Public hearings on the Neighborhood Traffic Study were well attended, and correspondence received before and during the hearing process revealed a high level of understanding and interest in the subject of traffic control. The correspondence before implementation was heavily in favor of the Traffic Management Plan. It is quite natural that those who are in favor of Traffic Management were most active in communicating their desires before the plan was implemented while those who are opposed have been most active following Plan implementation. Hence, the gross numbers of communications received should not be regarded as a reliable indicator of the balance of public judgment with regard to the Plan. They are, however, an important indicator of the key issues of concern in the community and provide some useful input to possible modifications of individual devices and area schemes.

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